PETROCHEMICALS TODAY
...Complete Plant Survey

OIL AND GAS JOURNAL

FRANKS STAR FEATURES Reveal Why Superintendents Prefer Franks Rockets and Why Contractors Make Money Using Them:

★ No guy line rigging
★ Fastest rig up and down
★ Franks air rod lift transfer
★ Legal in weight
★ Franks famous hoist. Smoothest high capacity clutch yet developed. Hydraulically adjusted. Air controlled.

Now available with torque converter drive to truck as well as hoist; hydraulic drive for power tongs; hydraulic drive for rotary table.

Franks Rocket Rod and Tubing Pulling Unit for most economical hoisting of wet string tubing with rods from shallow to deepest wells.

Franks on the spot field service available at: Alice, Casper, Compton, Great Bend, Houston, Kilgore, Odessa, Seminole, Edmonton and Tulsa with stocks of parts and factory trained personnel. Only Franks offers this complete service. Export: 149 Broadway, New York.

Not Among The Best, But The Best

FRANKS MFG. CORP. TULSA, OKLAHOMA

"on the SPOT" FIELD SERVICE

NOTE: This ad is repeated due to great interest of our contractor and producer friends.

Units Now Available For Quick Delivery

PRICE 50 CENTS TABLE OF CONTENTS ON PAGE 1 **OCTOBER 26, 1953**

Working Storage

CB&I Field Welding Supervision Service

As each welded steel structure built by Chicago Bridge & Iron Company is erected, a Field Welding Supervisor assists the Foreman during its construction to train and supervise welders and check welding equipment and welding techniques. He also helps magnaflux, x-ray or stress-relieve welds if called for in the specifications and supervises the cutting and grading of the correct number of test plugs. This complete service is provided on every Horton welded structure built . . . at *no extra cost* to you!

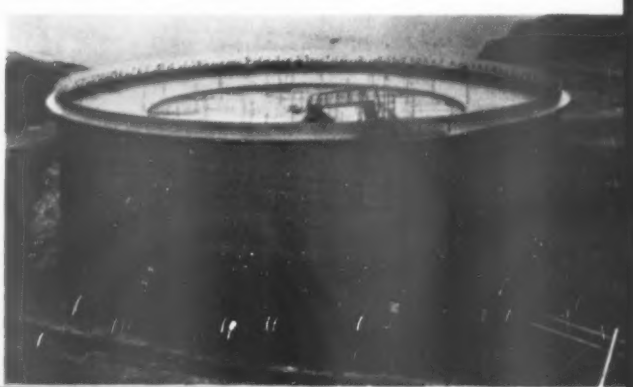
Horton Floating Roofs are built in three types—Double-Deck, Pontoon and Pan. Write our nearest office for further information, estimates or quotations.

FOR A WORKING PUMP STATION

The endless job of receiving crude oil and delivering it aboard tank ships is one that requires a real working terminal. Crude from producing fields in the San Joaquin and Santa Maria valleys is stored at Union Oil Company's Avila station, below San Luis Obispo, Calif. This busy terminal often handles two ships at a time and, by working day and night through periods of heavy demand, have loaded up to fifty tankers in a single month.

To assure a constant flow of crude for the tankers, efficient *working storage* is a must at Avila . . . and tanks equipped with Horton Floating Roofs are supplying that storage. Horton Floating Roofs reduce evaporation losses, corrosion and fire hazard. They are especially effective on tanks that are filled and emptied often.

Top: Aerial view of Union Oil Company's Avila, California, pipe line terminal showing tanks with floating roofs. Right: 142-ft. diam. by 48-ft. tank with a Horton Pontoon Floating Roof at Avila, Calif.



CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

Atlanta, 3	2154 Healey Bldg.	Detroit, 26	1514 Lafayette Bldg.	Philadelphia, 3	1615-1700 Walnut Street Bldg.
Birmingham, 1	1536 North 50th St.	Havana	402 Abreu Bldg.	Pittsburgh, 19	3228 Alcoa Bldg.
Boston, 10	1025–201 Devonshire St.	Houston, 2	2119 C & I Life Bldg.	San Francisco, 4	1554—200 Bush St.
Chicago, 4	2128 McCormick Bldg.	Los Angeles, 17	1523 General Petroleum Bldg.	Seattle, 1	1325 Henry Bldg.
Cleveland, 15	2204 Midland Bldg.	New York, 6	3347—165 Broadway Bldg.	Tulsa, 3	1606 Hunt Bldg.

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Horton Steel Works Limited, Fort Erie, Ontario, Canada
Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348, Caracas, Venezuela
Comprimo N.V., 21, Amstel, Amsterdam (C) Netherlands
Compagnia Tecnica Industrie Petroli, Rome, Italy
Whessoe Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Sociedade Chibridge de Construcoes Ltda., Av. General Justo, 275, Grupo 306, Rio de Janeiro, Brazil

the OIL AND GAS JOURNAL

OCTOBER 26, 1953 VOL. 52 NO. 25

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In Brief . . .

1. MUSHROOMING PETROCHEMICALS . . . In this special 16-page tabular report the Journal presents an up-to-the-minute survey of the North American petrochemical plants. Careful study of this report shows: (1) For the United States the survey lists 255 operating plants, including ammonia, sulfur conversion, and carbon-black plants; (2) the tables show 37 new plants or units definitely under construction or planned for construction, excluding carbon-black or sulfur conversion; (3) a total of 138 companies is listed for both organic and inorganic petrochemical operations; (4) there are 35 oil companies engaged in organic petrochemical manufacture or raw-material supply; (5) there are 51 chemical companies using petroleum-derived feed stocks to make organic chemicals; and (6) there are 24 Canadian petrochemical plants. Ethylene is the No. 1 feed stock used in making petrochemicals. Use of L.P.G. feed stock is gaining, and there is a large potential for use of acetylene.

2. 1952 PETROCHEMICALS . . . For the year 1952 petrochemicals comprised 21 per cent of the United States chemical production. This amounted to 21.4 billion pounds of the entire production of 100.4 billion pounds. The value of petrochemicals was 2.7 billion dollars out of a total of 5.4 billion dollars for the entire chemical industry. The petrochemical portion is made up of 2.2 billion dollar of aliphatics, 300 million dollars of aromatics, and 200 million dollars of inorganics. The average sale price per pound of the aliphatics was 15 cents; of aromatics, 19 cents; and of the inorganics, 2.5 cents. Total 1952 assets of the petrochemical industry of 2.5 billion dollars were about 52 per cent of the entire industry.

3. BETTER ROTARY POWER . . . When a power-transmission device, such as a fluid coupling, a torque converter, or an eddy-current coupling, is used on the rotary rig, these advantages accrue: (1) Shock loads are materially reduced, and increased life in the power train may be expected; (2) torsional vibrations from engine crankshaft are smoothed out; (3) engine cannot be stalled; (4) synchronization of engines within allowable slip range; and (5) effect of power-train shocks on engine is minimized.

The Petroleum Industry Insists On

HARTZELL Fans for Its

Cooling Towers and Heat Exchangers

Hartzite plastic for cooling tower and heat exchanger fan blades was developed especially to meet the rugged requirements of the petroleum industry. After more than ten years of service in the most punishing installations, Hartzite blades have proved themselves beyond all expectations.

What evidence is there of the superiority of Hartzell cooling tower and heat exchanger fans with Hartzite blades? Nearly every Hartzell fan installed since the introduction of the Hartzite blade in 1941 is still in service. And in nearly every case, where one Hartzell fan has been installed on a battery of cooling towers or heat exchangers, more Hartzells have followed as other blades needed replacement.

Fabric-base Hartzite absorbs vibration. Its strength is many times that necessary to withstand normal stresses. Its unusual resistance to corrosion and abrasion is constant throughout the blade. Hubs are of welded steel with an extremely high safety factor.

These are the reasons why Hartzell has become "the" cooling tower and heat exchanger fan in the petroleum industry.

For the complete story, send for Bulletin 1503.

HARTZELL *propeller fan co.*

Div. of Castle Hills Corp.

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Company _____

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City & State _____

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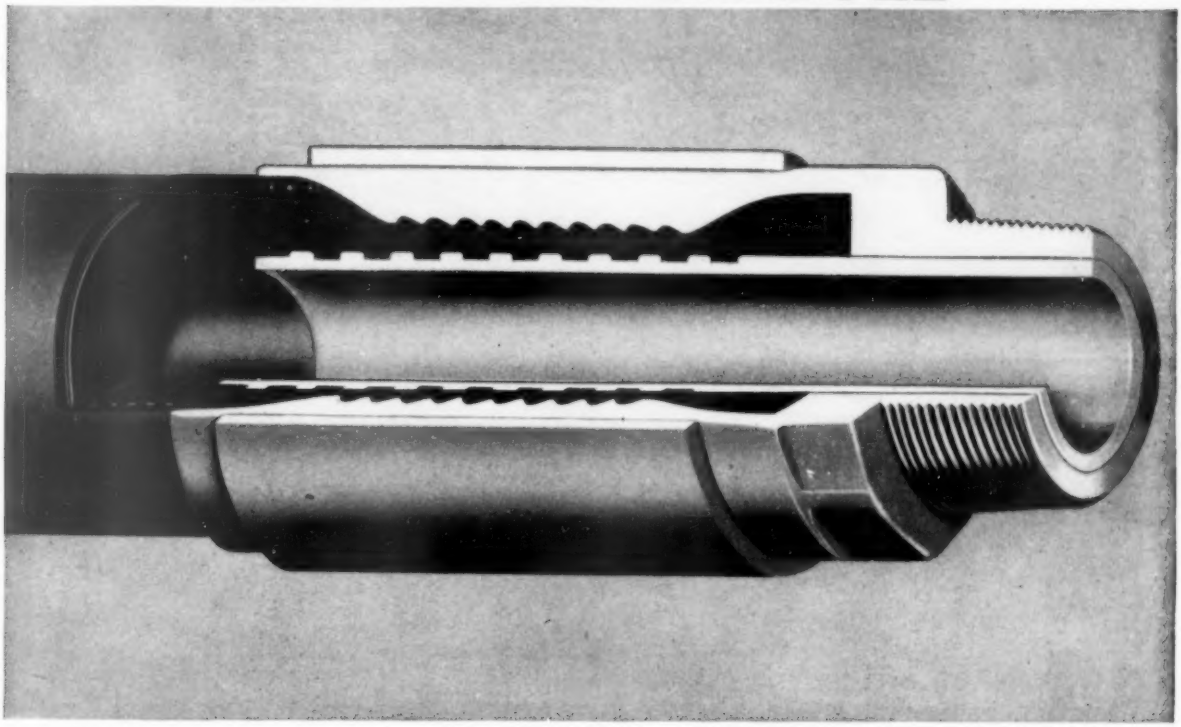
PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



This guaranteed leakproof coupling has a bulldog's grip

No drilling pressure is high enough to put a leak in a B. F. Goodrich Permalock hose coupling—nor budge it even a fraction of an inch from the bulldog grip its teeth sink into the hose end.

Applied to rotary drilling hose under hydraulic pressure, the Permalock coupling is *permanently* secured by a powerful lock ring so it can never tear loose nor weaken.

This B. F. Goodrich Permalock coupling is shorter, too, adding only 30 lbs. per end—where long, built-in couplings add 80 lbs. That's 100 lbs. less to handle when coupling up.

Permalock's inside diameter is the same as the hose, allowing full flow at all times. Mud cannot wear out its special high-carbon steel lining. In fact, the whole coupling is guaranteed *for the life of the hose!*

B. F. Goodrich Highflex rotary drilling hose with Permalock couplings is available at leading supply houses in the major drilling areas, or you can get it anytime—day or night—from one of these B. F. Goodrich warehouses: Dallas, Houston, Kilgore, Odessa, Wichita Falls, Great Bend, Oklahoma City, Tulsa, Williston, Denver and Los Angeles.

If you would like further information on the Permalock coupling, hose, or any of the products B. F. Goodrich makes for the oil field, send the coupon below.

The B. F. Goodrich Company
Dept. M-61, Akron 18, Ohio

Without cost or obligation, please send me information on:

- ☐ Rotary drilling hose
- ☐ Grommet V belts
- ☐ Other products (name type) _____

Name _____

Company _____

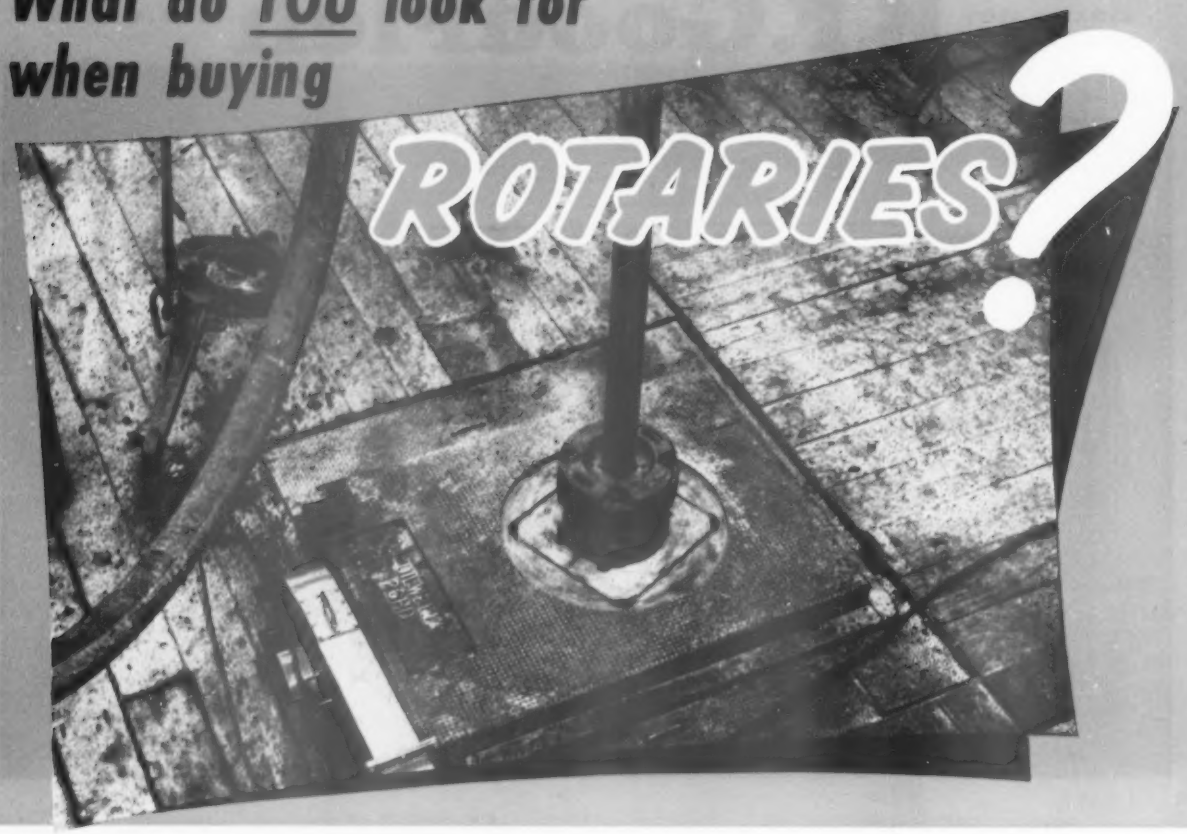
Address _____

City _____ Zone _____

State _____

B.F.Goodrich
INDUSTRIAL PRODUCTS DIVISION

What do YOU look for when buying ROTARIES?



If it's DEPENDABLE PERFORMANCE

. . . you'll like the quiet operation, freedom from vibration and foolproof design of "Oilwell" Rotaries—from the smallest to the largest models. Self-centering, angle-contact, large-diameter main ball bearings completely support the turntable and its drill-string load. Cast-steel turntable is precision balanced for smooth, vibrationless rotation. Large-diameter, pinion-shaft assembly is equipped with a safe, simple and convenient pinion-shaft lock.

If it's EASY MAINTENANCE

. . . you'll be amazed at the ease with which the pinion-shaft assembly can be serviced and either outer or inner bearings replaced when needed without stripping the entire shaft. Drilling mud is prevented from working through a grease-sealed labyrinth between the turntable and base during "wash-down" operations, and a flexible sealing ring bends upward to form a tight seal when struck by mud from below. With reasonable attention, the oil reservoir in "Oilwell" Rotaries need never become contaminated with mud.

If it's LONG SERVICE LIFE

. . . you'll appreciate the way "Oilwell's" patented oil-bath lubricating system maintains a constant flow of oil to cushion wearing surfaces regardless of operating speeds. This reduces wear to a minimum. Rigid one-piece cast-steel bases are heavily ribbed to provide high strength-for-weight ratios and form oil reservoirs completely surrounding the turntables. Conservative load ratings for all models provide extra strength for emergencies.

SERVICE RATINGS

"Oilwell" Rotary	17½-C & 17½-D	20½"	26-HD
Rated Dead-Load Capacity	200 tons	250 tons	350 tons
Rated Drilling Depth	9,000 ft.	13,000 ft.	17,000 ft.
Gear Ratio	3.28:1	3.82:1	3.84:1
Maximum Table Openings	17½ ins.	20½ ins.	26 ins.

Contact **. . . your nearest "Oilwell" Representative the next time you're buying Rotaries and let him give you complete specifications on the "Oilwell" line . . . or ask for Booklet No. 7-53.**

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UNITED STATES STEEL CORPORATION

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Branches Serving All Oil Fields

USS TRADE MARK

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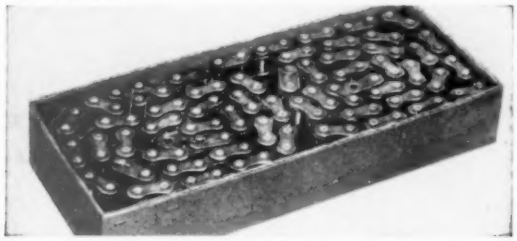
CHAIN ASSEMBLY...CHAIN REPAIR

THERE'S NOTHING TO IT!

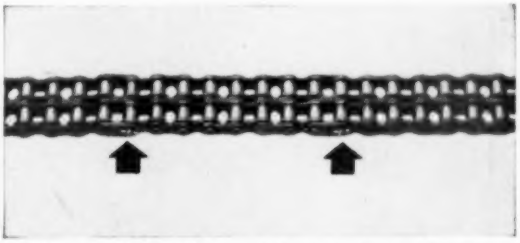
WITH IMPROVED BALDWIN ASSEMBLY RIVETED ROLLER CHAIN

When it comes to coupling, uncoupling or repair of roller chain either at the rig or in the supply store, the improved Baldwin Assembly is your time-saving, money-saving, trouble-saving, temper-saving answer. There's virtually nothing to it. Here's all you do:

TO TAKE THE CHAIN APART

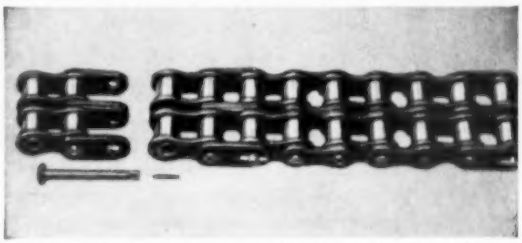


1 You buy Baldwin Assembly Chains in a packaged unit —a 10-foot strand in every box. Each chain is made up of sections of varying lengths joined by single coupler pins. Stretch out the assembled chain.



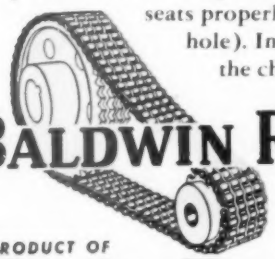
2 Locate and mark the coupler or couplers to be disconnected. Their distinctive straight edge side plates, locking pins and washer heads make them easy to locate.

3 Remove locking pin and drive flatted end of the coupler pin out of its side plate. Then tap it out the rest of the way with a drift pin. Before driving out the pin, back up the opposite side of chain with hammer or vise grip pliers to avoid springing the side plates.



4 That's how easy it is to take this chain apart. If a section you need is in the middle of the strand...just remove the coupler pin on either side of the section desired.

TO REASSEMBLE THE CHAIN. To couple this chain, just line up the free end of the coupler link with the adjacent roller link. Back up the link with hammer or vise grip pliers. Drive in the pin (being sure the flatted end seats properly in the flatted side plate hole). Insert the locking pin, and the chain is now reassembled.



BALDWIN REX®
ROLLER CHAINS

A PRODUCT OF
Chain Belt COMPANY
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It will pay you to investigate the Improved Baldwin Assembly. You'll find it will simplify your chain problems and save you real money. Ask about it at your supply store or use the coupon to send for Bulletin 52-3. Baldwin Rex Oil Field Sales Offices located in New York • Tulsa • Dallas • Houston • Midland • Los Angeles.

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Milwaukee 1, Wis.
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Company.....

Address.....

City.....*State*.....

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LOOK TO a.C.f. FOR GREATER

FREEDOM FROM RISK!

FRANKLY, these giant 30,000 gallon propane storage tanks represent a considerable investment. That's why, before their purchase, Celanese engineers studied many similar installations under similar operating conditions. As a result of this study, they placed an order with a.C.f. Why? Because a.C.f. craftsmanship, manufacturing standards, stress relieving of every tank and the all-seeing x-ray technique for inspecting every inch of welded seam... has earned for a.C.f. storage tanks a greater margin of safety. It drastically reduces risk, makes possible installations in all the choicest locations.

Thousands of a.C.f. storage tanks (from 6,000 gallon capacity on up) are located all over the country. Your nearby a.C.f. Representative will be glad to direct you to some near you, help you get on-the-job operating facts and give you complete details. American Car and Foundry Company. New York · Chicago · St. Louis · Cleveland · Washington · Philadelphia · San Francisco.

and the a.C.f. LINE *for*

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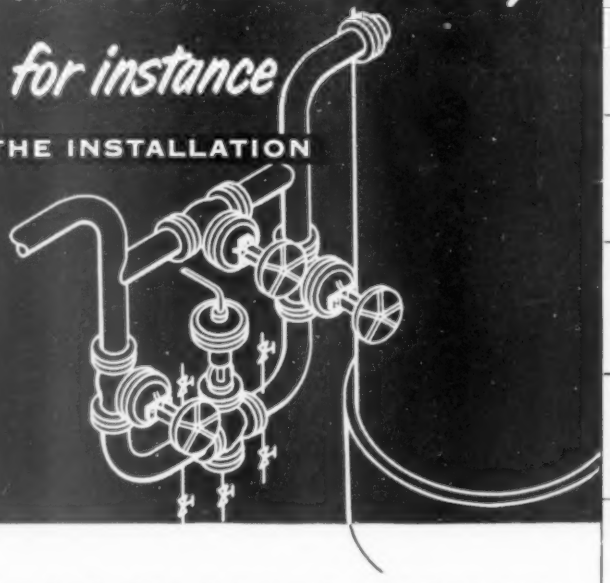
a.C.f. *Quality you can trust*

You Can Measure this Valve's Quality on Hot Oil Service, for instance

THE INSTALLATION



In a leading lube oil plant on the Gulf Coast, using Crane Steel Valves on hot oil extraction lines from tower in Duo-Sol unit. Working pressure 100 psi at 850 degrees F.

VALVE SERVICE RATINGS

SUITABILITY:	Couldn't be better
FEATURES:	Exelloy trim
MAINTENANCE COST:	Routine service only
SERVICE LIFE:	No efficiency loss since 1951
OPERATING RESULTS:	Safe, dependable control
AVAILABILITY:	Catalog item — No. 47X

THE CASE HISTORY

Valves formerly used here were identical in design and appearance with their Crane replacements. But the similarity ended there. For they gave continual trouble in this round-the-clock process. Sticking discs made them extremely difficult to operate. They failed to hold tight on closure. Their replacement became mandatory for efficient operation.

It's been a different story since Crane 47X steel gates were installed almost 2 years ago. No more sticking of discs . . . no leakage anywhere . . . and with only routine maintenance.

THE VALVE

Work horse of the petroleum industry—Crane 150-pound steel gates—with exceptional performance assured by Crane quality design . . . Crane metallurgy . . . and the high adaptability of Crane Exelloy trim for oil and oil vapor services. Sizes 2 to 24 in.; screwed, flanged, welding ends. See your Crane Catalog or Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

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Branches and Wholesalers Serving All Industrial Areas

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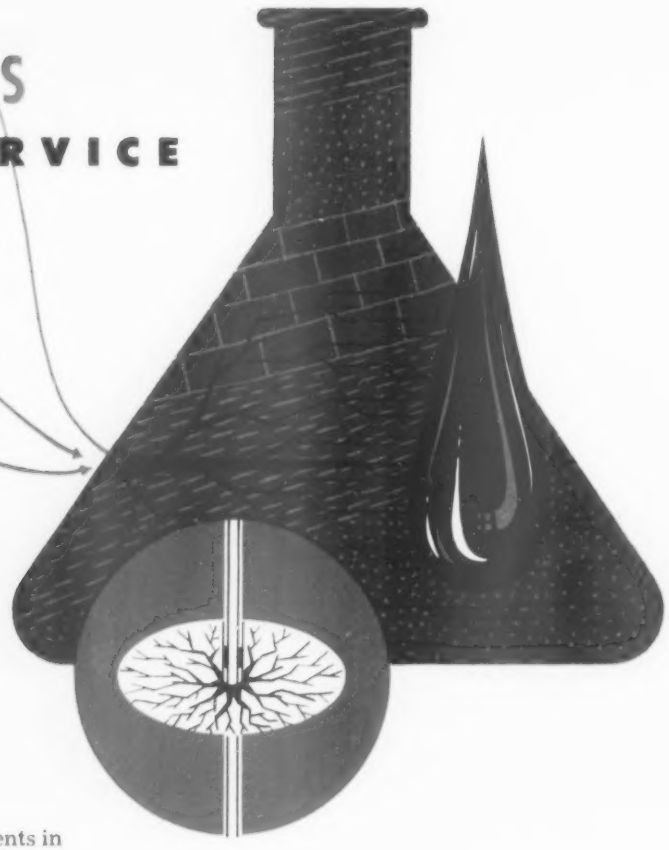
HALLIBURTON'S
HYDRAFRAC SERVICE



OUTSTANDING PRODUCTION STIMULANT !

Growing success of Hydrafrac treatments in fracturing formations results from improved techniques that keep ahead of rapidly changing requirements.

Four years ago a small pump and a few steel tanks were used on a job. Material consisted of about 50 barrels of treating fluid containing 100 pounds of sand.

But repeated success demonstrated that larger quantities of fluid and sand could be beneficial in creating production increase. Now, a treatment in the Spraberry Trend of West Texas might call for six 15,000 psi working pressure pumps to displace 600 barrels of treating fluid, containing 32 tons of sand to serve as propping agent.

Results have been outstanding. 75% of all wells treated with Hydrafrac Service responded successfully with an additional oil recovery averaging 175%. Correct evaluation of well data by Halliburton experts is invaluable in determining when and where this remarkable service can best be used to stimulate productive flow.

Before passing up any possible pay in new wells or old, find out if Hydrafrac Service can increase your production. Phone your nearby Halliburton representative. Or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

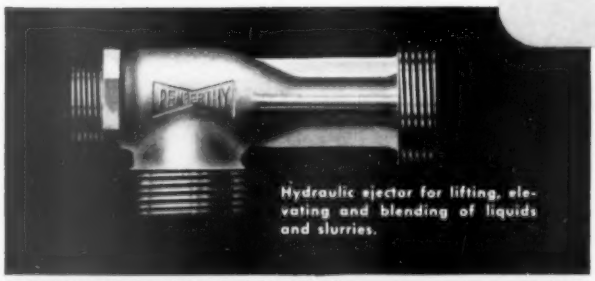
HALLIBURTON

Hydrafrac—Reg. U.S. Pat. Off.

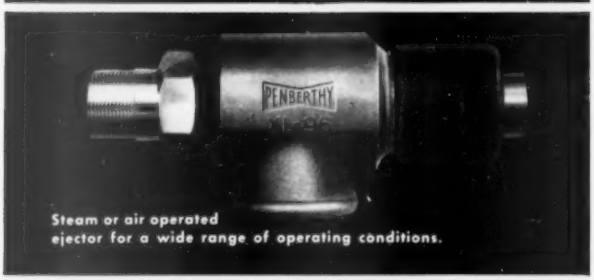
YEARS AHEAD IN PRODUCTION IMPROVEMENT TECHNIQUES!

LOW COST...
COMPACT...
TROUBLE-FREE...

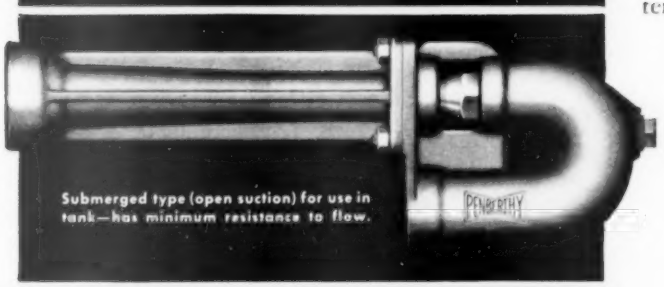
PENBERTHY
JET PUMPS



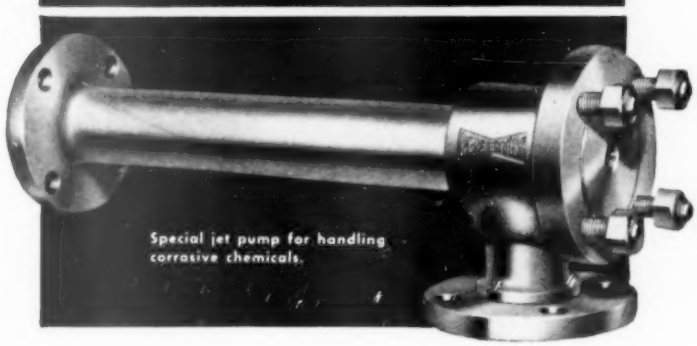
Hydraulic ejector for lifting, elevating and blending of liquids and slurries.



Steam or air operated ejector for a wide range of operating conditions.



Submerged type (open suction) for use in tank—has minimum resistance to flow.


Special jet pump for handling corrosive chemicals.

Consider the simplicity of the jet pump. It uses steam, water, air or gas under pressure to transfer or mix, without clogging, *any liquid which will flow through pipes.* It has no moving parts or packing glands. Needs no lubrication or maintenance. It's practically noiseless, costs little and is compact.

Penberthy makes a full range of jet pumps. They are being used in standard and unusual applications. Where necessary, they are made to withstand corrosion, contamination and high temperatures.

Penberthy, from wide experience, can help you save time and money, increase the efficiency of your operation. Take the first step by writing for Bulletin No. 512 which details the complete line of jet pumps by Penberthy.

*

Established 1866

PENBERTHY INJECTOR COMPANY

Division of the Buffalo-Eclipse Corporation

1244 Holden Avenue
Detroit 2, Michigan

There's Certain satisfaction in **PRODUCTS BY**

PENBERTHY

- **CYCLING JET PUMPS**
- **EJECTORS**
- **INJECTORS**
- **ELECTRIC SUMP PUMPS**
- **EDUCTORS**
- **EXHAUSTERS**
- **SYPHONS**

Sure cure for many a headache...

DARLING CAST STEEL PIPE LINE GATE VALVES

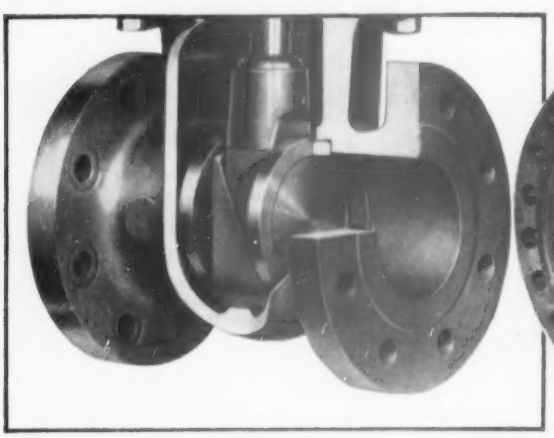
IF you're a believer in "proof of the pudding", you have only to check with Darling users to get facts on how Darling pipe line valves can save you time and money and prevent chronic valve headaches. For one thing, there's Darling's unique *fully revolving, double disc, parallel seat feature* . . . revealed in the cutaway view. It's simplicity itself, but it wins hands down by cinching:

1. Positive, easy, tight closing. **2.** Automatic adjustment for valve body distortion. **3.** Elimination of gate-to-seat galling. **4.** Uniform wear distribution. **5.** Greater service life with less maintenance.

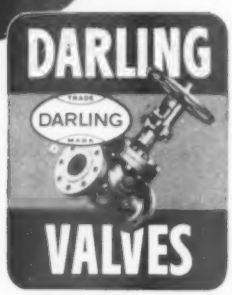
SEND FOR DATA — Space here won't permit a complete explanation of just *why* this feature gives you these and many other important advantages. That's why we suggest that you send for *all* the facts. Darling parallel seat gate valves come in a wide range of sizes and constructions for main line, gathering, manifold, tank farm and all other pipe line services. Outline your particular service needs or ask for complete descriptive bulletin.

DARLING VALVE & MANUFACTURING CO.
Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario



Darling 22" Series 400 motor-operated cast steel, fully revolving, double disc, parallel seat pipe line gate valve for cold pressures up to 800 lbs. Darling pipe line gate valves have full seat opening, same as I.D. of pipe, allowing free passage of line scrapers.



FOR PLUS VALUES, JOB PROVED AGAIN AND AGAIN

THE powerful, dependable Cat* D397 Oilfield Engine above plays a double role for Socony-Vacuum Oil Company, Inc.

Driving a Byron Jackson Multiplex 4x6 R. B. pump, this compact, power-packed engine is used for emergency duty at stations along the line. But while it waits, it works! It pumps about half the total capacity at the Berland Station near Zurich, Kan. But despite its tremendous capacity for work, it can be moved easily and set into operation in a matter of hours in some far-off station.

How much does this double-duty operation cost? A fraction of a cent per barrel! The D397, like all Cat Oilfield Engines, is designed to operate on low-cost, non-premium, No. 2 furnace oil without fouling. *Most models perform on crude oil.*

Maintenance costs are low, too. Fuel, air and lube oil filters, and seals keep dust and abrasives out of the engine. Normal maintenance can be done in a few minutes. It's a simple matter of changing the lubricating oil and cleaning and changing the filters.

Leading manufacturers of oilfield equipment can supply Cat Diesels in their products. Engine and electric sets are available in 12 sizes up to 500 honest HP and 315 KW. Your Caterpillar Dealer is ready to prove how these engines help cut costs and build profits.

Caterpillar Tractor Co., Peoria, Illinois.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks

**WE'VE MADE CLAIMS...
NOW MAKE US PROVE THEM**

A girdle 'round the globe

The total length of G-R Finned Tubing that has been furnished for heaters, coolers, condensers and heat exchangers would circle the world.

More than 70,000 Twin G-Fin Sections . . . just one of the many types of G-R Finned Tube Units . . . have been installed, serving the broadest range of applications of any heat transfer apparatus on the market. Many thousands of K-Fin Air and Gas Coolers have been built for stationary plants and shipboard. For more than 30 years, G-R Finned Tubing of various designs has been widely used for heat transfer apparatus ranging from tubular units to open sections.

Thus, each design of G-R Finned Tubing has given complete proof of its effectiveness and also its durability. Investigate the applications of these time-proven heat transfer elements for *your* plant, particularly for handling viscous liquids and gases. Write for bulletin describing their features and uses, and the types of exchangers for which they can be furnished.

G-R G-Fin Longitudinally-finned Tubing . . . specially adapted to transfer of heat to and from liquids of higher viscosity than water.

G-R K-Fin Helically-finned Tubing . . . specially adapted to transfer of heat to and from vapors and gases.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

G-R HEAT TRANSFER APPARATUS *Finned Tubing*

GR 293

Save the beans— throw away the holes

• Illustrated — Unibolt Flow Manifold for single wing tree, consisting of Unibolt Tee, Wing Valve, and Positive Choke Body.

LOW COST

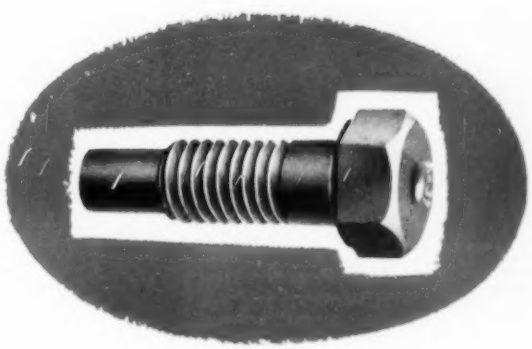
UNIBOLT

X-BEAN INSERTS MAKE POSITIVE CHOKES AS GOOD AS NEW

You don't have to change beans. Change inserts. You accomplish the same results but for a fraction of the cost. Unibolt Master Beans, for Unibolt Choke Bodies and Unibolt Cage Nipples, are drilled to receive a small replaceable insert. So, when the insert wears out just replace it . . . save the bean.

These little inserts are available in **42 "X" sizes under 14/64ths.** That means that they are drilled in increments of 5% and 10% of well flow rather than in increments of 1/64th inch. Consequently, the flow of fluid or gas can be positively controlled with a degree of accuracy never before attained. If, for example, a well produces 10 bbls. through a 1/64-inch choke, to increase the choke to the next largest fractionally drilled size, 2/64-inch, would increase the production to approximately 40 bbls. On the other hand, a well that produces 10 bbls. through a size X-35 UNIBOLT X-Bean would produce only 10½ bbls. through the next largest size X-Bean, X-35.5; 11 bbls. through an X-36, and so on.

This accurate control of production is a safeguard against the harmful effect of periodically pulling a well too hard in order to make its allowable.



THORNHILL UNIBOLT CRAVER CO.

P. O. BOX 1184 HOUSTON, TEXAS

Combined trip-throttle valve permits operator to throttle steam directly into G-E Type DP Mechanical-Drive Turbine, usually eliminating need for extra valve in steam line.

ANOTHER PLUS VALUE OF G-E MECHANICAL-DRIVE TURBINES...

Combined Trip-throttle Valve Cuts Turbine Installation Costs

To save you the cost both of buying and installing a throttle valve in the steam line, General Electric designed into its standard Type DP mechanical-drive turbine a trip valve which also functions as a throttle valve. This feature alone can save you up to $200.00 at time of installation.

The combined trip-throttle valve controls steam admission to the turbine on starting and also shuts off all steam in case of overspeed. No need in most cases to shut off steam valves ahead of the turbine before restarting the unit. The combined trip-throttle valve can quickly be reset and the turbine put back on the line, saving you time in an emergency.

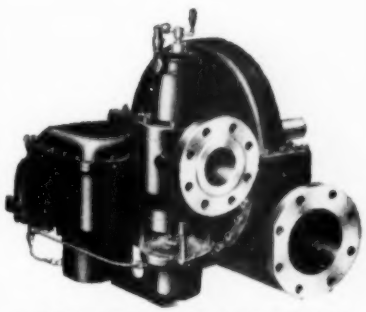
THIS COMBINED TRIP-THROTTLE VALVE is just one of many DP features which save you money. The chart below indicates other areas of savings.

Remember—the total cost is often more than just the sales price. But G.E.'s standard DP turbines include the extra features to save you extra costs. For more information contact your nearest G-E apparatus sales office. Write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines," General Electric Company, Schenectady 5, N. Y. 252-63

GENERAL ELECTRIC

INSTALLATION AND MAINTENANCE COST-SAVING FEATURES

THESE EXTRA FEATURES, STANDARD ON ALL G-E TYPE DP TURBINES, CAN . . .	Save You up to
COMBINED TRIP-THROTTLE VALVE Eliminate extra cost of buying and installing valve ahead of the turbine.	$200.00
SINGLE RESERVOIR FOR COOLING LUBE OIL Eliminate extra cost of piping cooling water to and between bearings.	50.00
MAJORITY OF PARTS INTERCHANGEABLE One set of spare parts protects several units—less money tied up in inventory.	100.00
METALLIC-LABYRINTH VALVE STEM BUSHING Eliminate labor costs of replacing soft packings; cut down-time production losses.	50.00
SHAFT MONEL-SPRAYED AT PACKING FIT Saves frequent cost of purchasing and installing carbon rings; contributes to long shaft and packing life.	20.00
ESTIMATED TOTAL SAVINGS	$420.00



G-E Type DP Mechanical-Drive Turbine

COMPARE THE FEATURES
EVALUATE ALL THE COSTS

See why G-E standard Type DP turbines are your most economical buy.

CABOT pumping units get better all the time!

Ask the J&L men you know what you could reasonably expect to gain from Cabot units. Delivered to your lease by men trained in assembly and set-up.

A RUBBER BEARING joins the walking beam and pitman — torsional deflection instead of friction. Nothing to lubricate. Wonderful shock absorber. Patented.

CRANK BALANCE that one man can adjust without a truck and a crew.

REDUCTION employs Sykes-cut herringbone gears, flood lubricated. No oil seals used or needed on reducer shafts. Timken and Hyatt roller bearings.

It has always been possible to lift a barrel of oil for less money with a simple, sensible Cabot.

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION
SUPPLY DIVISION

Serving The United States and Canada
General Offices: TULSA, OKLAHOMA
J&L Tubular Products and Wire Rope

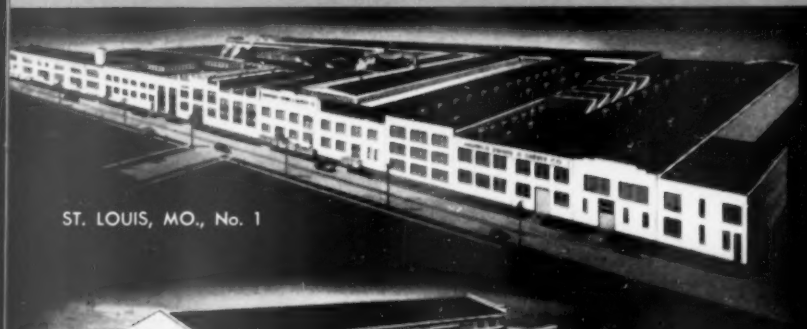
P·E·S·A
PARTNERS IN PETROLEUM PROGRESS

Users of Piping

whether a simple bend welded assembly or

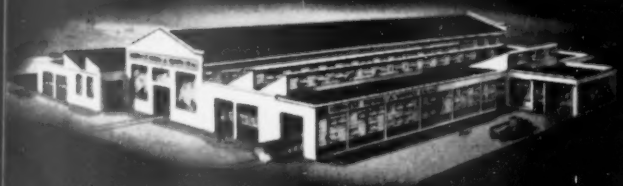
complete piping systems for power plant or process

get Multiple Advantages from MIDWEST Multiple Plants

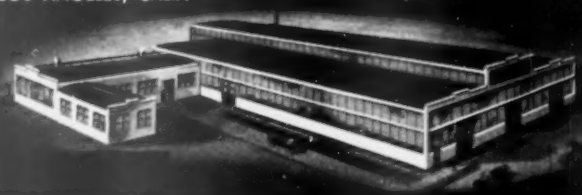


ST. LOUIS, MO., No. 1

ST. LOUIS, MO., No. 2



LOS ANGELES, CALIF.



PASSAIC, N. J.

BOSTON, MASS.

Strategically located multiple plants and large scale operations have made it economically practicable for Midwest to develop much special pipe fabricating machinery and to conduct piping research that would be impossible under other circumstances. Multiple plants create a friendly rivalry between the organizations of these plants that advances the art of piping fabrication more rapidly than would otherwise occur. All these activities are reflected in better fabricated piping . . . in greater piping value per dollar. • Multiple plants help make Midwest the preferred source for prefabricated piping. 4909

MIDWEST

PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and Boston

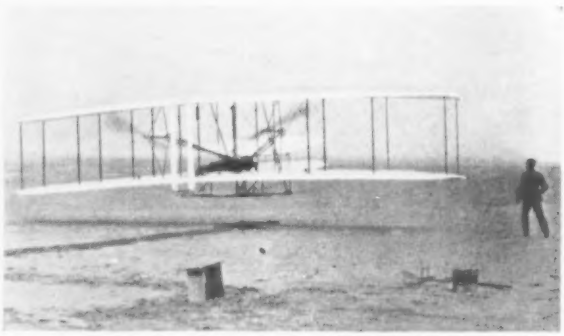
Sales Offices: New York 7—80 Church St.
Los Angeles 33—320 Anderson St.
Boston 27—426 First St.
Chicago 3—79 West Monroe St.
Tulsa 3—224 Wright Bldg.
Houston 2—1213 Capitol Ave.

PIPING FABRICATORS AND CONTRACTORS FOR MORE THAN 50 YEARS

FOR 50 YEARS

The Greatest Name in Motor Oil!

Before 1903 motor oils used in cars had been developed for other purposes. Then came *Mobiloil*—first *successful* motor oil specifically developed for cars—and the auto industry was on its way!



It was at Kitty Hawk in 1903 that the Wright brothers made the first successful plane flight. On this occasion, and on other pioneering flights, they chose *Mobiloil* for top engine protection!

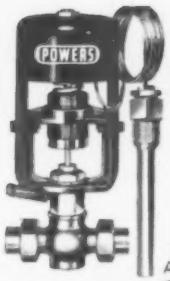
Today's car builders generally recommend a *heavy-duty* motor oil. New super-detergent *Mobiloil* more than meets this requirement—cuts engine wear, helps give longer engine life, better economy!

Today's sky-clippers set new safety records with oils made by the makers of Mobiloil!

1903 · 1953 50TH ANNIVERSARY

Why Sell Anything Less?

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

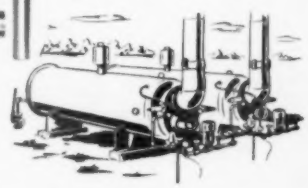


POWERS No. 11-OFT REGULATOR

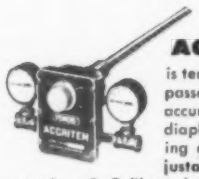
for Heaters and Treaters

Self-Operating • Dependable Economical

Has many features that give better control and long, trouble-free service without repairs . . . in all kinds of weather.



Applied to BS&B Indirect Heaters

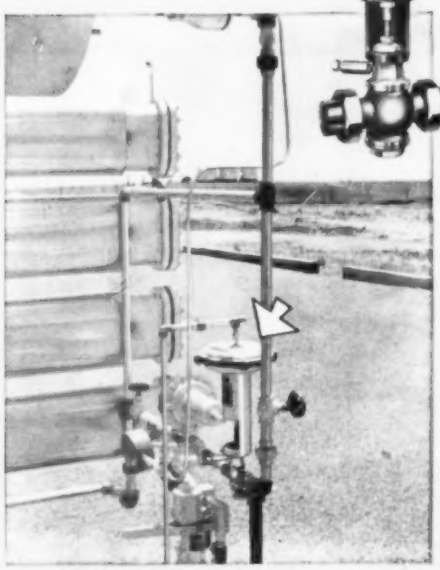


ACCRITEM REGULATOR

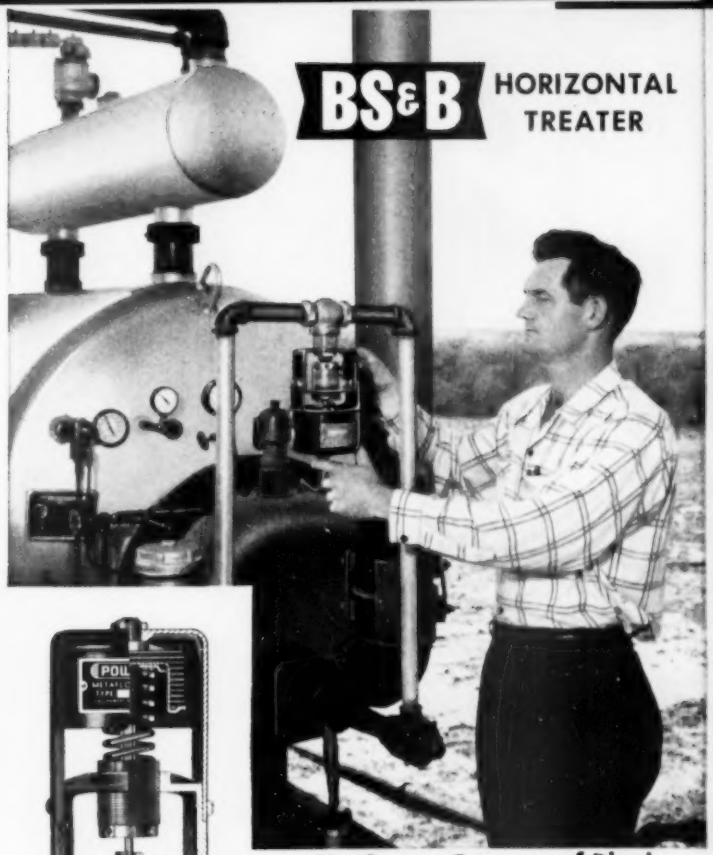
is temperature actuated and unsurpassed for reliability and power to accurately control large or small diaphragm valves regulating heating or cooling mediums. **Has Adjustable Sensitivity** and over-heat protection. • Calibrated Dial temperature adjustment. • Ranges 50 to 250° F. and 150 to 350° F. • **Simple, Rugged Construction** withstands vibration and insures many years of reliable service. Requires 15 lb. supply of compressed air or gas for its operation. Write for Bulletin 316.

POWERS FLOWRITE DIAPHRAGM VALVE

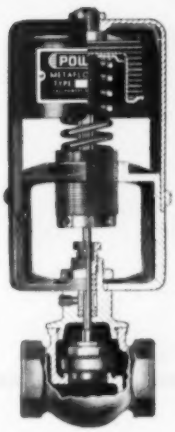
is a high quality diaphragm control valve for line pressures below 250 psi. Its durable molded Neoprene diaphragm with its advanced design features and special piston plate assembly, adjusting screw and bonnet assembly make it one of the best valves obtainable in its pressure range. One of its many applications is shown below.



POWERS FLOWRITE VALVE controlling gas heater to Dehydrator unit in gas booster station at El Paso Natural Gas Co., Snyder, Texas.



Mr. George Freeman of Black, Sivalls & Bryson, adjusting a



POWERS METAFLOW DIAPHRAGM VALVE

POWERS METAFLOW VALVE

Used as a Pressure-Stat on the above Horizontal Treater—

There are many profitable uses for this small, sturdy, lightweight, reasonably priced diaphragm control valve. It's suitable for applications where pressures are below 75 psi.

Specifications: Has a long life hydraulically formed metal bellows, a brass adjusting screw, and rust-proofed steel spring with 15 lbs. adjustment range. Polished stainless steel stem in preformed lubricated packing insures long life and low hysteresis. **Valves**—sizes ½ thru 2" have bronze bodies with screwed ends and rugged construction to withstand piping strains. Valve stem lubricator, optional. **Trim**—Composition disc with integral seat and self-aligning disc holder, available normally open (direct acting) or normally closed (reverse acting).

Write for Bulletin 346

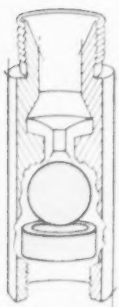
(b26

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS • Offices in Over 50 Cities in U. S. A., CANADA and MEXICO

See Your Telephone Directory

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL



1/3 Lighter than Steel

Lasts 20 times longer

Used in sub-surface check valves, Kennametal Light-Weight Titanium-Carbide* Balls minimize down-the-hole trouble caused by ball flutter, cage wear, and fluid pounding.

Their titanium carbide and nickel content assures higher resistance to corrosion and electrolytic action. They provide unexcelled performance in sour crudes and hydrogen sulfide gases.

Diamond-like hardness of these Kentanium Balls increases valving efficiency in pumping flour-sand cut fluids and other abrasive mixtures. Sphericity is maintained in conditions of severe impact, ball spin-wear, and cage beating.

Remarkable lightness of the Kentanium Ball reduces friction and impact shock — an important factor in slant pumping, or where cages of soft metal must be used.

You can obtain Kennametal Light-Weight Titanium-Carbide Balls from your regular supplier.

**called Kentanium*

KENNAMETAL®

PUTS AN END TO DOWN-THE-HOLE CHECK VALVE TROUBLE

Quality Sintered Carbide API Balls and Seats

Manufactured by

Kennametal Inc., Latrobe, Pa.

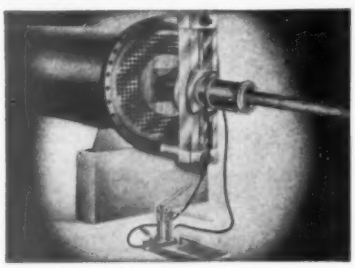
SOLD BY YOUR REGULAR SUPPLIER

PROCESS EQUIPMENT NEWS

PUBLISHED BY FABRICATED PRODUCTS DIVISION, THE M. W. KELLOGG COMPANY OCTOBER 1953

Exchanger Shops Altered to Handle Increased Demands of Chemical Industry . . .

For many years, Kellogg's Exchanger Fabricating Shops in Jersey City concentrated on supplying exchangers for Kellogg's many refinery construction jobs and for making critical exchangers for specific outside customers. However, during World War II the facilities were expanded to produce exchangers for a host of marine and general chemical applications, as well as to handle business from other contractors. Since then this general demand has continued to increase . . . and the Shops have just been rearranged to insure prompt deliveries.



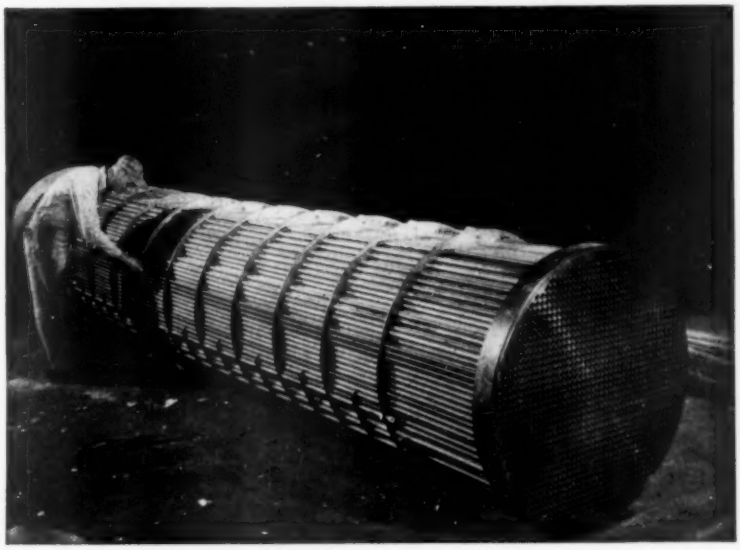
Hydro-Ejector Operates in Number of Refineries

Shown here is the new Kellogg portable Hydro-ejector now in use by a number of refiners and chemical plant operators. The Hydro-ejector removes and inserts the largest bundles with ease . . . eliminates costly steel work to support conventional methods.

For further information, details of methods, etc. contact

FABRICATED PRODUCTS DIVISION
THE
M. W. KELLOGG COMPANY
225 Broadway, New York 7, N. Y.
or offices in Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London & Paris

KELLOGG PULLMAN



Nearly 200 Stainless Exchangers Completed in Less Than 18 Months

This stainless steel tube bundle, being inspected prior to insertion in its stainless-clad shell, is one of 187 such exchangers recently completed by Kellogg for a huge new chemical plant. The last unit was shipped less than 18 months after the order was received.

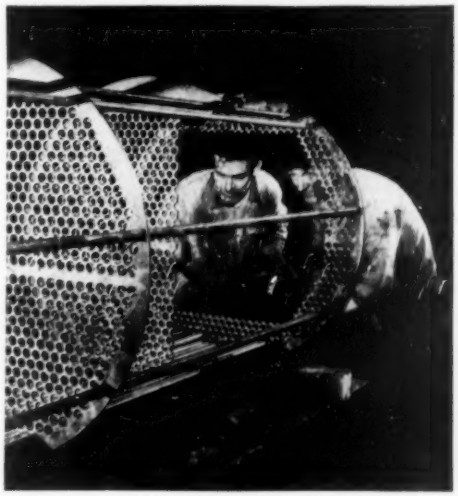
While there were minor variations in designs, the illustrated unit is typical of the exchangers involved. Carrying twenty foot long tubes and measuring almost 48 inches in diameter, it will handle highly corrosive materials. The tubes are of type 316 stainless and the tube sheets and baffles are of type 304. The shell is stainless-clad.

Condenser Bundles Prove Precision Line-Up of Tube Sheets and Baffles Essential

Undesirable stresses can readily be built-into any exchanger during fabrication if tubes do not slide through baffles and into tube sheets with ease.

Only with precision line-up prior to inserting tubes is it possible to insure that the tubes will enter the bundle without use of excessive force.

Kellogg's close tolerance machining of tube holes and painstaking line-up make the insertion of tubes a relatively easy task in the fabrication of this propane condenser bundle. When complete it will contain 889 admiralty tubes. Baffles are of naval brass and approximately 33" in diameter.



EXCHANGERS
THIN WALL ALLOY PIPING
CLAD STEEL VESSELS
CONDENSERS
FRACTIONATING TOWERS
PRESSURE PIPING
DIGESTORS
COOLERS

AVONDALE has 3 complete facilities for a well rounded service to the Oil Industry

MAIN YARD • Avondale, Louisiana . . . ship and barge building and repairs, tank cleaning, steel fabrication, and pipe-joint platforms for offshore drilling.

HARVEY YARD • Harvey, Louisiana . . . quick repairs, drydocking, and propeller service.

SERVICE FOUNDRY • New Orleans, Louisiana . . . iron, steel and non-ferrous castings, cut gears, and large capacity machine work.

AND NOW . . . As a further development Avondale has, under construction, a plant and facilities of large capacity for the manufacture of architectural porcelain enamel products, such as: load-bearing walls, exterior curtain walls, and allied materials. Production on a volume basis will begin about January, 1954.

ANOTHER FORWARD STEP IN THE INDUSTRIAL GROWTH OF AVONDALE!

AVONDALE MARINE WAYS, INC.

P. O. BOX 1030, NEW ORLEANS 8, U.S.A.

MAIN PLANT
Avondale, La. • UNiversity 4561

"QUICK REPAIR PLANT"
Harvey, La. • EDison 4211

SERVICE FOUNDRY
416 Erato St.—New Orleans • CAnal 3836

At no extra cost—

versatile

SPANG "CW" STEEL PIPE

for

OIL-GATHERING SYSTEMS

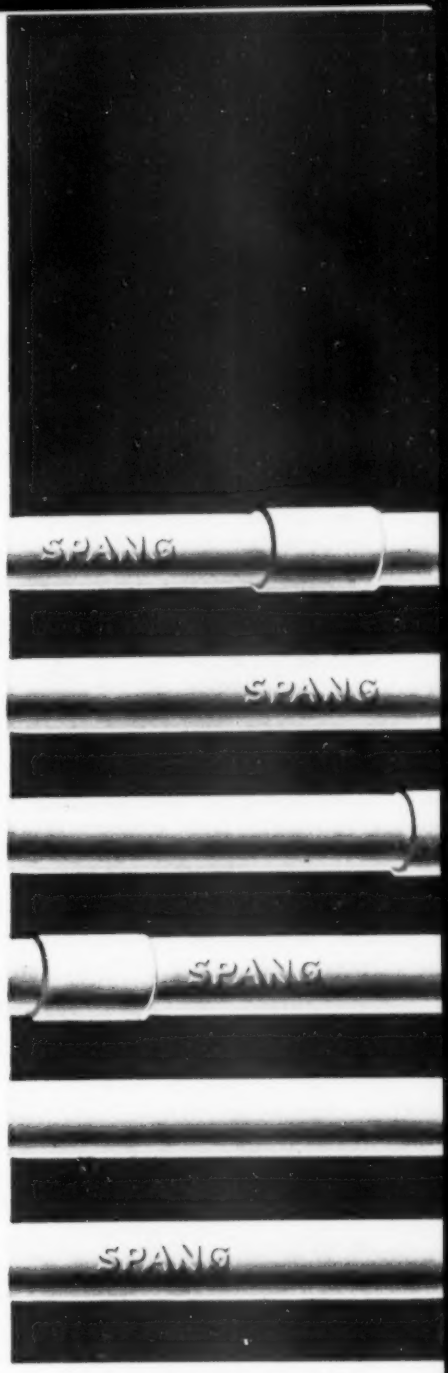
WATER SYSTEMS

AIR LINES

GAS LINES

WATER-FLOODING LINES

SALT WATER DISPOSAL LINES



Whatever the oilfield application may be, its installation will be quickly accomplished at lower labor cost when versatile SPANG "CW" Steel Pipe is used.

There's good reason why SPANG "CW" is so versatile... it's *quality-controlled* pipe. Because of this careful control . . . especially during forming . . . it has exactly the right temper to give easy bending, easy cutting, and easy threading. This means that SPANG "CW" can be installed faster and at less cost in oilfield applications. Versatility plus its exceptional service life at no extra cost makes SPANG "CW" your best buy.

Don't just order pipe... ask for SPANG "CW" Steel pipe, normally available in a complete range of standard sizes at your nearby National Supply Store.

SPANG-CHALFANT DIVISION

THE NATIONAL SUPPLY COMPANY

Pittsburgh 30, Pennsylvania

DIVISION TUBULAR OFFICES: Denver, Colorado • Houston, Texas Fort Worth, Texas • Los Angeles, California • Pittsburgh, Pennsylvania • Tulsa, Oklahoma • Calgary, Alberta, Canada

NATIONAL OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE • SUPERIOR & ATLAS ENGINES

THE NATIONAL SUPPLY COMPANY NSCO NATIONAL BLUE PRODUCTS

Here Are Facts You Should Know About Electric Motor Bearings

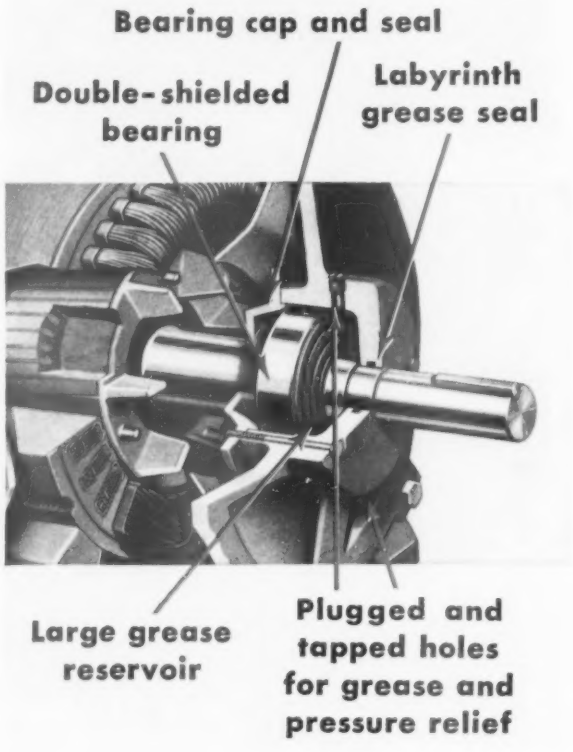
AN ideal motor bearing would operate for indefinitely long periods under all types of conditions without requiring any attention whatever. However, in the opinion of our engineers, such a bearing and its attendant lubricant are not yet available on the commercial market. Consequently, bearings for many types of operations, particularly where overloading, extreme temperature ranges and chemical and dirt laden atmospheres are involved, require special lubricants or regular lubrication schedules.

Of course, bearings suitable for many kinds of operation under normal conditions can be built to require no attention for very long periods — usually several years. Allis-Chalmers can supply sealed bearings in all frame sizes through 505 on short delivery and without extra cost for applications of this type.

Which is the Best Design for *Your* Application?

We believe that the design used in standard Allis-Chalmers drip-proof, tefc and explosion-proof motors represents the best design for most industrial users.

The Allis-Chalmers standard design consists of a pre-lubricated, double-shielded bearing mounted in the end housing with a generous grease reservoir. Plugged and tapped holes are provided for grease and for pressure relief. Under normal operating conditions, this design will operate as long without attention as any other type of bearing in use today. But where difficult operating conditions make re-lubrication desirable, it can be done as part of the normal lubricating routine without dismantling the motor.


Bearing cap and seal
Double-shielded bearing
Labyrinth grease seal
Large grease reservoir
Plugged and tapped holes for grease and pressure relief

The large grease reservoir and shielded bearing design assure that grease lost from the bearing due to high operating temperatures or other causes will be replaced automatically.

For further information on bearing design and other features of Allis-Chalmers motors, call your nearby Allis-Chalmers District Office or Authorized Distributor.

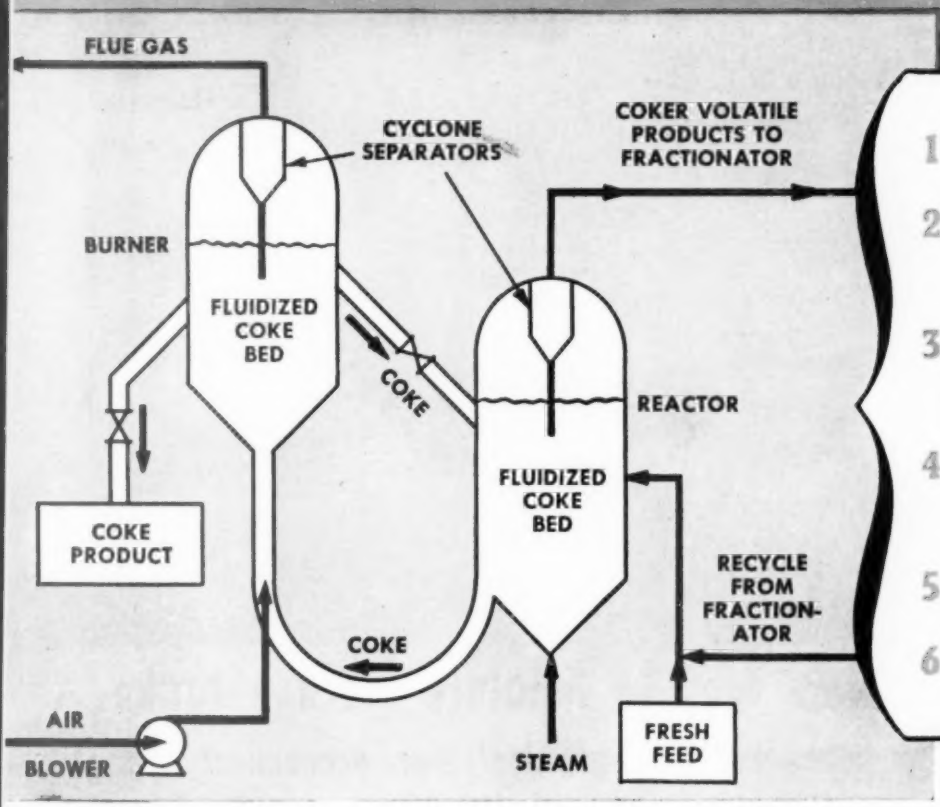
A-4147

ALLIS-CHALMERS

Milwaukee 1, Wisconsin

FLUID COKING*

offers you these advantages



1. **Continuous operation**
2. **Broad flexibility of both feed and products**
3. **Higher ultimate gasoline yield**
4. **Residual products yield reduced to a minimum**
5. **Low plant investment**
6. **Economical operation**

* *Licensed by Standard Oil Development Co.*

McKee Engineering Assures You Correct Plant Design

MCKEE services assure you a Fluid Coking plant designed and constructed to obtain fullest advantages of this new process.

MCKEE Company's enlarged process engineering facilities, design, engineering, purchasing and construction services are backed by a long, successful record on all types of refining facilities.

For Fluid Coking, as for all the other refining processes, you can depend on it—*McKee Engineering means Assured Results.*

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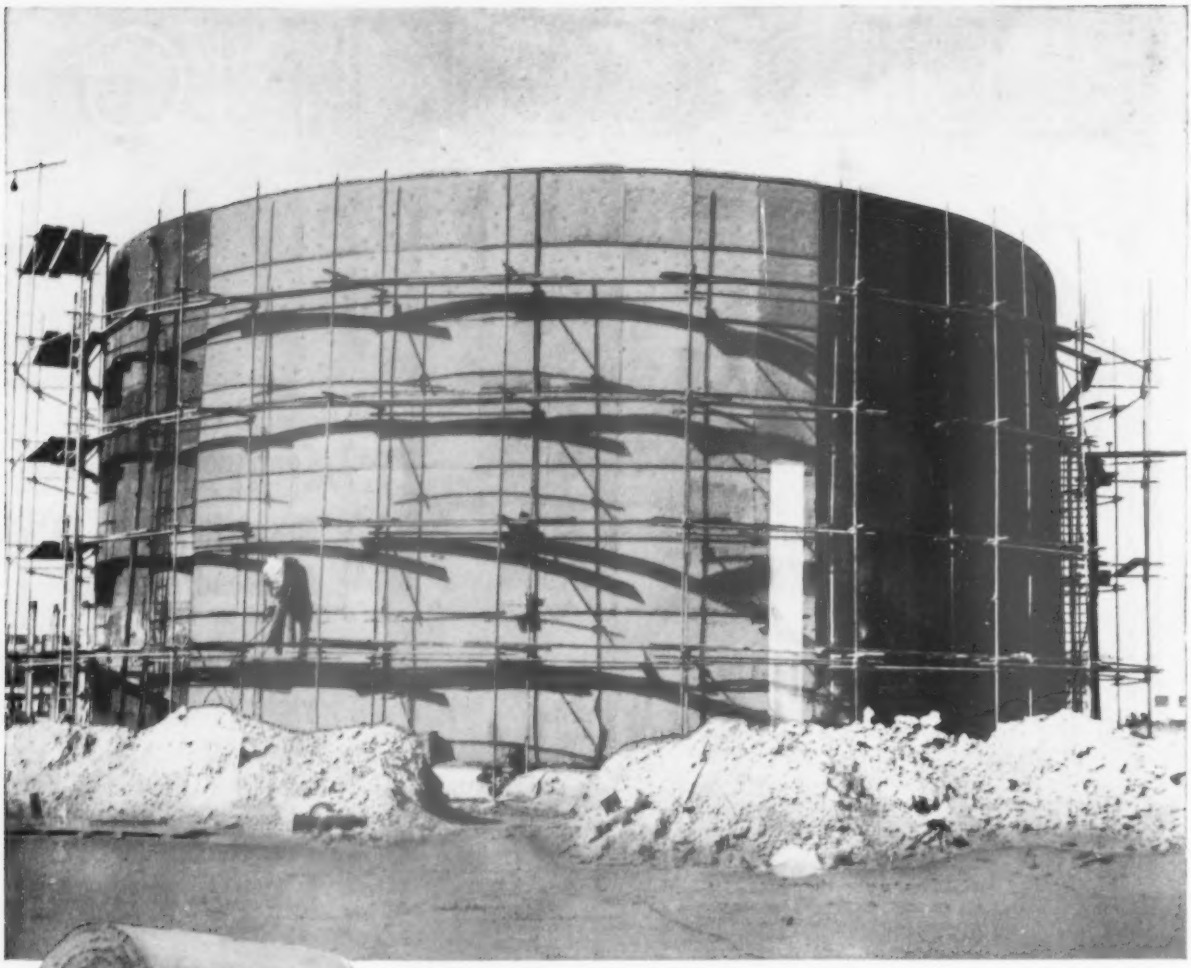

Contractor on the above illustrated job was the Joplin Cement Co., Joplin, Mo.

New Way to insulate storage tanks-

permanent, more efficient, more economical

If you could insulate *400 square feet* or more of a storage tank in one easy operation, how much could you save over the block-at-a-time method? You'd save plenty — as others are doing with ULTRALITE long glass fiber insulation.

The method is simple: Take a blanket roll of Ultralite and cut off strips the same length as the height of the tank. Start at the top of the tank and let a strip of lightweight Ultralite float toward the ground, impaling it on welded studs as it goes. No wiring, no banding. Just that quick, one part of the tank is insulated from top to bottom, and the insulation crew moves on, keeping well ahead of the men who apply the sheet metal jacket.

No expansion joints necessary . . . no damage from water . . . no heat loss from "fluing action" . . . no problems when tank repairs are necessary — for ULTRALITE is resilient, reusable, won't absorb moisture!

Write today for "how-to-do-it" specifications and name of your local Ultralite distributor

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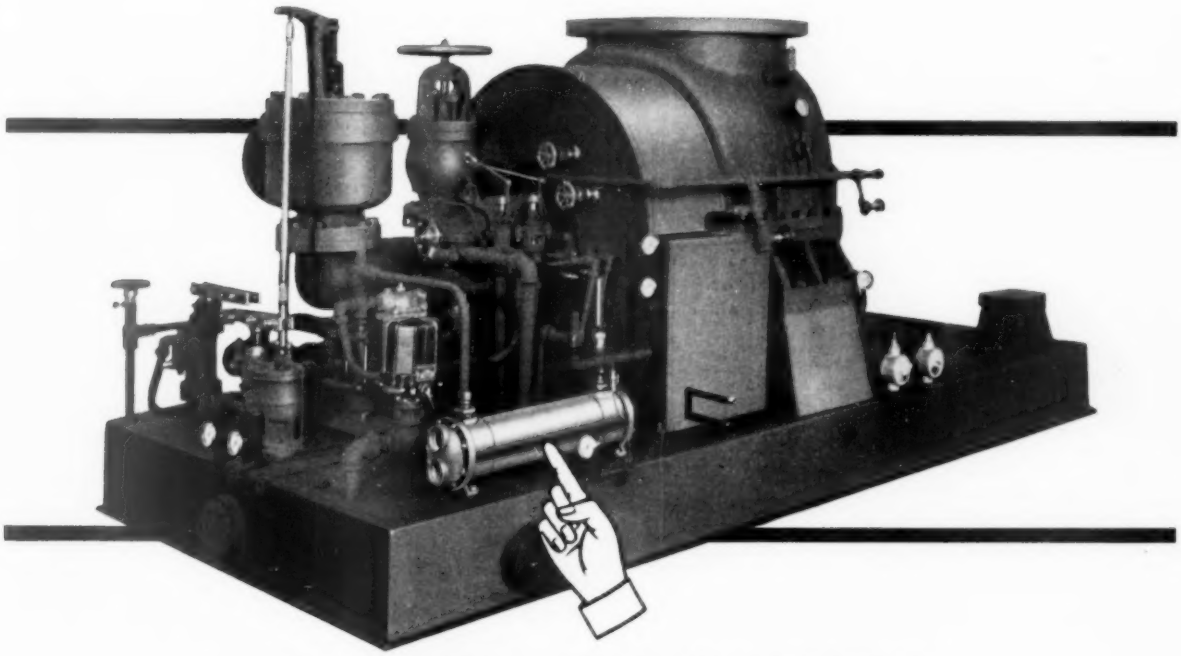
keeping oil temperature at proper operating level in this Terry Turbine



A ROSS EXCHANGER

Driving a centrifugal compressor in demanding refinery service, this Terry Multi-Stage Turbine is rated 2700 hp at 8500 rpm. To provide oil temperature control for the unit's variable speed oil relay governor, main journal and thrust bearings, The Terry Steam Turbine Company factory-installed a Ross Type BCF Exchanger. An adequate supply of dependably cooled lube oil, at correct viscosity, is thus assured at all times.

Regularly written into specifications where high thermal efficiency and extreme ruggedness are of prime importance, Ross Exchangers are widely preferred throughout the oil and gas industry as standard components of engines, compressors, speed increasers, transformers and hydraulic equipment.

Pre-engineered, fully standardized, all copper and copper alloy Ross Type BCF Exchangers are stocked in a wide range of sizes to meet most requirements . . . *promptly*.

Detailed information is in Bulletin 1.1K5. Write.

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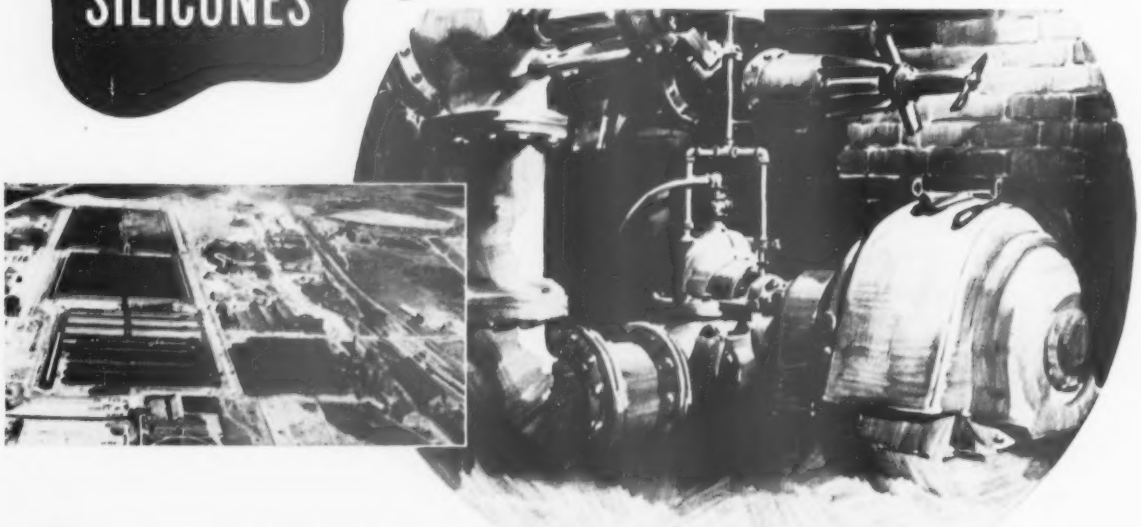
DOW CORNING
SILICONES

give motors more muscles



Seventeen 100 to 250 hp motors uprated by 50%; save over $50,000

Largest aluminum producing plant in the world, the Arvida Works of the Aluminum Company of Canada, Ltd., (Alcan) increased its capacity several times in the past few years to a current high of 2 million pounds of ingot per day. Over a year ago an obstacle to further expansion turned up in the ore plant, where bauxite is mixed with a caustic solution to separate the alumina. Called on to handle larger quantities of caustic solution, the plant was unable to replace their existing pump motors with larger motors. There was simply no room for them.

Alcan maintenance engineers neatly solved that problem by rewinding all 17 of their 100, 125 and 250 hp motors with Class H insulation made with Dow Corning silicones. Total power output was increased by more than 50%. The cost of rewinding with Class H materials was $50,000 less than the list price of the equivalent capacity in new motors. And that doesn't include the far greater expense of installing larger pedestals, changing all the fittings, and rearranging the pump lines to accommodate larger motors. Furthermore, downtime was held to a minimum during the changeover.

Rewound with Class H insulation these motors have carried a 50% overload for over a year in spite of frequent spraying with caustic solution. And that's typical of the performance of Class H motors, regardless of size. They can carry heavy sustained overloads; operate with greater power efficiency where periodic overloads are involved; give 10 or more times the life of Class B motors under comparable service conditions. That's why alert management, maintenance and production men now specify Class H insulation for hard-working motors, generators and transformers.

mail this coupon today

Dow Corning Corporation
Dept. DS-10, Midland, Michigan
Please send me:

- ☐ Performance Data on Class H machines.
- ☐ List of Class H motor repair shops.
- ☐ Data on Silicone Grease for motor bearings.
- ☐ 24 page booklet entitled "Tall Tales and Fabulous Facts."

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You can also reduce or eliminate motor outages due to bearing failure; specify Dow Corning 44 Silicone Grease for motor bearings.

In open and single shielded bearings designed for high temperature operation, Dow Corning 44 has 8 to 10 times the life expectancy of conventional greases. It gives life-time lubrication in permanently sealed bearings.

DOW CORNING CORPORATION
Midland — Michigan

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sizes from 60 to 300 ton capacity at a 4 to 1 or more safety factor!

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BJ MEANS ENGINEERED OIL TOOLS

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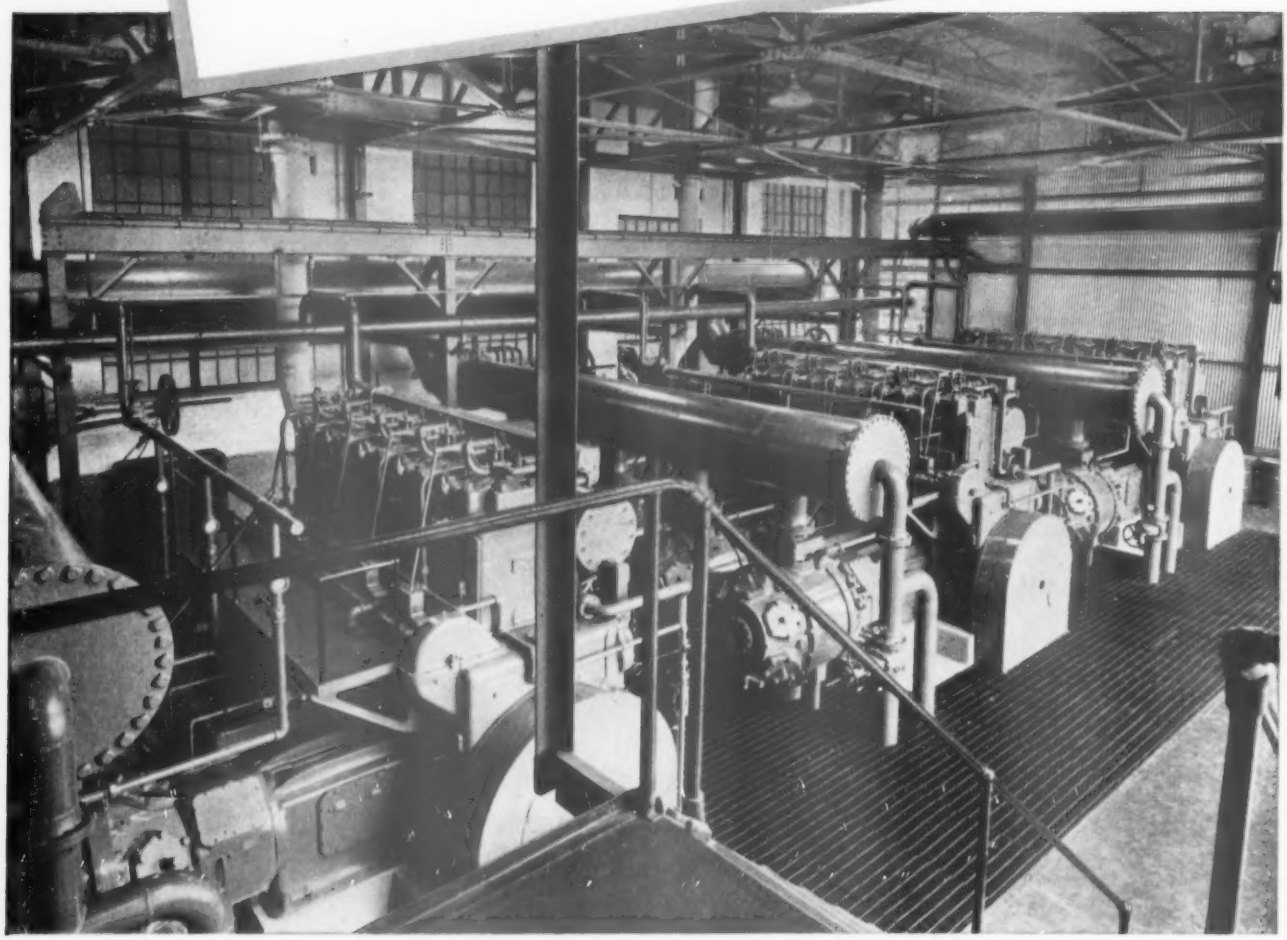
are peak load demands cutting into your profits?



Three Clark 1100 bhp, HBA-5, High Compression Gas-Engine-Driven Compressors operating in a Midwest gas utility booster station.

Here's what one gas utility did about it

Meeting peak load demands of an expanding industrial area recently became a critical problem for a major gas utility. For years, a steam compressor plant was used for all compression requirements. This necessitated operating all boilers on a "full steam" basis, 24 hours a day, even though peak loads were only of 20 minutes duration. Naturally fuel costs were high.

There was only one practical solution—conversion to gas-engine-driven compressors. They could be operated during the peak demand periods and readily taken off the line when not required.

Already using 8 Clark "Right Angles" in another plant, this utility knew what to expect from Clark Compressors. Three Clark 1100 bhp high compression "Big Angles" were therefore installed to handle the compressor requirements in this plant. Substantial savings in overall fuel costs, manpower and maintenance have resulted from the conversion.

Whatever your conditions, whatever fuel you have available, Clark can serve you most economically. Clark builds steam, gas, Diesel and motor driven compressors in both reciprocating and centrifugal types. You can *depend* on unbiased Clark recommendations.

Request Bulletin 104 for details on Clark "Big Angles."

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DIVISION OF DRESSER OPERATIONS, INC.

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CLARK compressors

GAS-ENGINE-DRIVEN • STEAM-ENGINE-DRIVEN • MOTOR-DRIVEN • CENTRIFUGAL • AXIAL FLOW

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NEW JOHNSTON
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Eases Pressure Change on Drill Stem Tests

Sudden Pressure Release — Shock to Formation

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The new Johnston HYDRAULIC TESTER is compact, rugged and positive

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Plugging, damage to wall of the hole; requires less water cushion.

GIVES

Smoother, more positive interpretation of productivity in the test zone.

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To open, apply drill pipe weight; to close, remove weight by picking up drill pipe.

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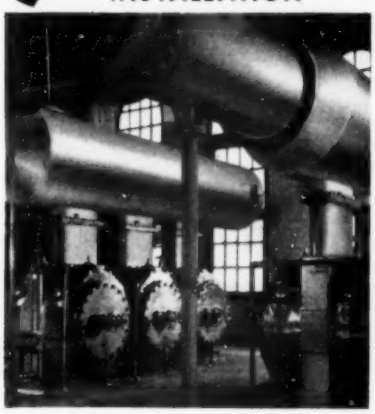
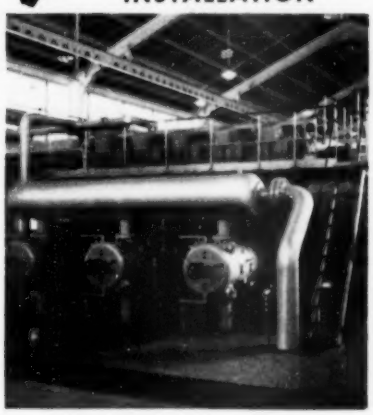
TYPICAL OIL-REFINERY INSTALLATION

TYPICAL GAS DISTRIBUTION INSTALLATION



TYPICAL COMPRESSOR STATION INSTALLATION



Burgess-Manning experience and "know-how" in the control of surge in gas and air piping can be of valuable service to all processing, engineering, and contracting companies faced with designing piping systems without pulsation problems.

Pulsation snubbing has proven its effectiveness in best efficiency, process action, gas transmission, and gas metering.

To help you overcome pulsation and vibration in gas and air lines excited by compressors, reciprocating pumps, or blowers, Burgess-Manning Company's specialized engineering group is available to study and analyze flow conditions. Recommendations and designs for each project will be developed as required. Supplemental field surveys can be made where existing operations are involved.

If you are confronted with the problem of reducing pulsation in gas pipe lines, consult with Burgess-Manning. Recommendations for your piping projects will be developed at your request.

BURGESS-MANNING COMPANY

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Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	14" to 18" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser

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The technical knowledge and skill of Baroid's dependable service and research team, supported by 25 years of field experience and energetic research, is quickly available night and day wherever wells are drilled throughout the United States and Canada.

Five hundred strategically located Baroid distribution points throughout the oil areas keep a complete line of drilling mud products only minutes from your rig.

These are the reasons why the word "Baroid" and the sight of the familiar blue service car are synonymous with the best in drilling mud products and services — for greater drilling safety — better mud control — lower drilling costs.

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For a quarter of a century Baroid has pioneered the development of mud testing equipment to determine the information necessary for proper control of drilling fluid properties.

Deeper drilling demands upon mud performance required much information that could not be secured with the first simple bucket and scale determination of density, and the funnel, cup and watch method of testing for flow properties. Many of the instruments and procedures provided to meet this increasing demand for information were either developed or improved by Baroid. These include the Baroid Rotary Viscometer, CO_2 Pressured Filter Press, Filtratester, Oil and Water Distillation Kit and High Temperature Aging Cell.

The first to provide and maintain a complete line of easy to use, rugged and accurate field testing equipment—Baroid has cooperated with API in establishing a standard test code and will continue to improve drilling fluid test equipment.

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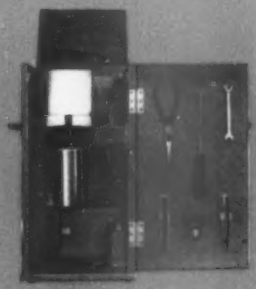
Today

Baroid Mud Balance

Baroid Filtratester



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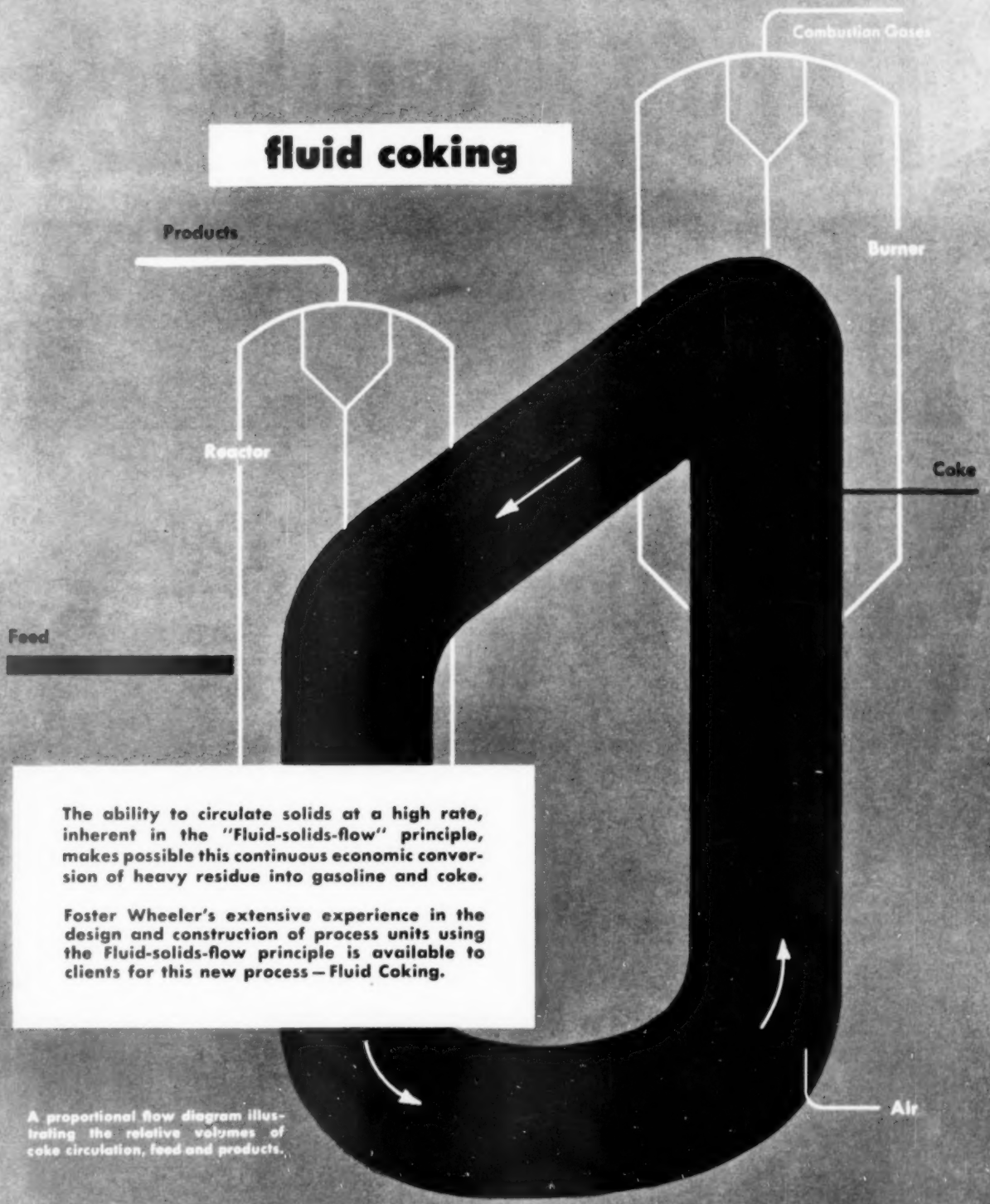
fluid coking



A proportional flow diagram illustrating the relative volumes of coke circulation, feed and products.

The ability to circulate solids at a high rate, inherent in the "Fluid-solids-flow" principle, makes possible this continuous economic conversion of heavy residue into gasoline and coke.

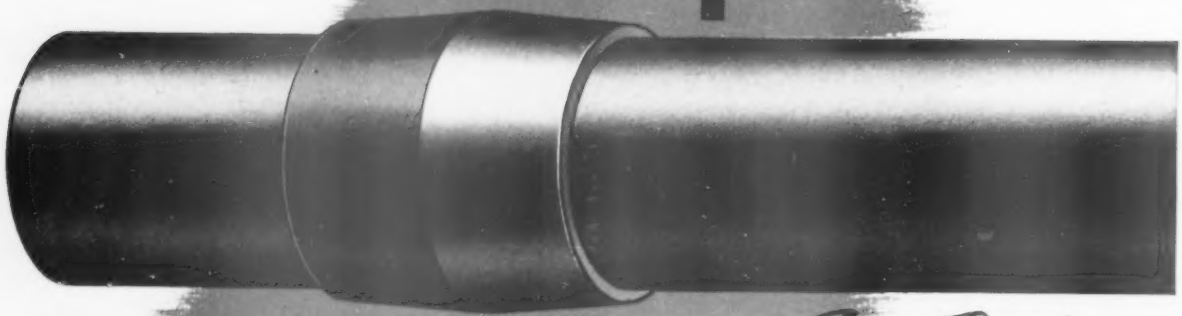
Foster Wheeler's extensive experience in the design and construction of process units using the Fluid-solids-flow principle is available to clients for this new process — Fluid Coking.

For further information on first cost, utilities, yields, operating economics, design and construction data, write to:

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

Here's Republic's



Semi-Rigid

EASY TO JOIN. Republic Plastic Pipe installation costs are low because field joints are easily made. There are plastic fittings available for many types of piping arrangements, including adapters for joining plastic to steel. Semi-Rigid is joined by a solvent welded sleeve type fitting. Flexible joints are made using insert type fittings and stainless steel clamps.

New PLASTIC PIPE

Republic Steel offers two new products that may solve some of your piping problems. They are Republic Semi-Rigid and Republic Flexible Plastic Pipe.

Semi-Rigid is made of butyrate, a material known for its high corrosion-resistance to petroleum products. You can use it for many kinds of flow lines including transmission of high paraffin crudes, sour crudes and salt water. You can also transmit low-pressure gas, sweet or sour.

Republic Flexible Plastic Pipe is made of polyethylene. Its oil field uses include water lines to drilling rigs and other cold water applications. It is not suitable for handling petroleum products.

Both of these plastic pipes have exceptionally smooth wall surfaces. This means a high rate of flow, reduced friction loss, low maintenance costs. Both are non-toxic. Both are lightweight. They're exceptionally easy to install. In-the-ground costs are surprisingly low.

Semi-Rigid is available in 9 sizes from ½″ to 6″. It comes in 20 and 40-foot straight lengths. It's available in coils in ½″, ¾″ and 1″ diameters. While normally supplied in black, clear pipe is available on request. Flexible also comes in 9 sizes, from ½″ to 6″. It's available in coils, in sizes ½″ through 3″ in diameter. In 4″ and 6″ diameters it is supplied in 25-foot lengths.

New Booklet No. 603 gives sizes, lengths, test pressures and other valuable information on Republic's new Semi-Rigid and Flexible Plastic Pipe. Write for it. It's Free.

Complete information on both of these new Republic Plastic Pipes is available in booklet No. 603. Write for it to:

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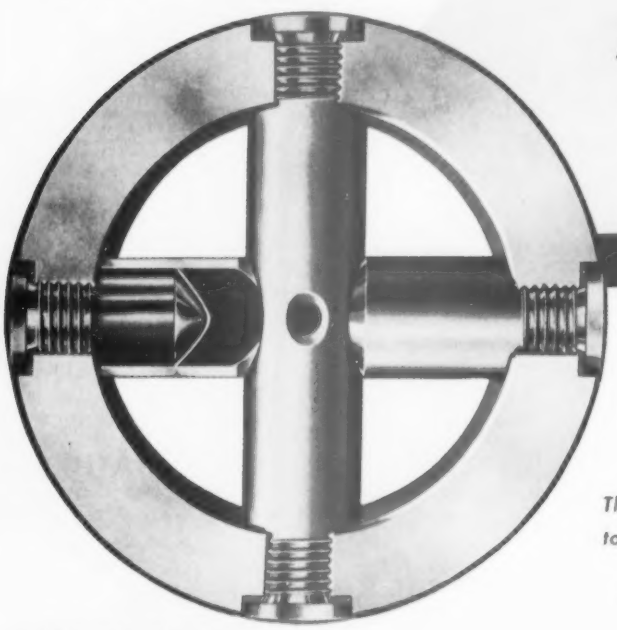
Republic
PLASTIC PIPE
SEMI-RIGID AND FLEXIBLE

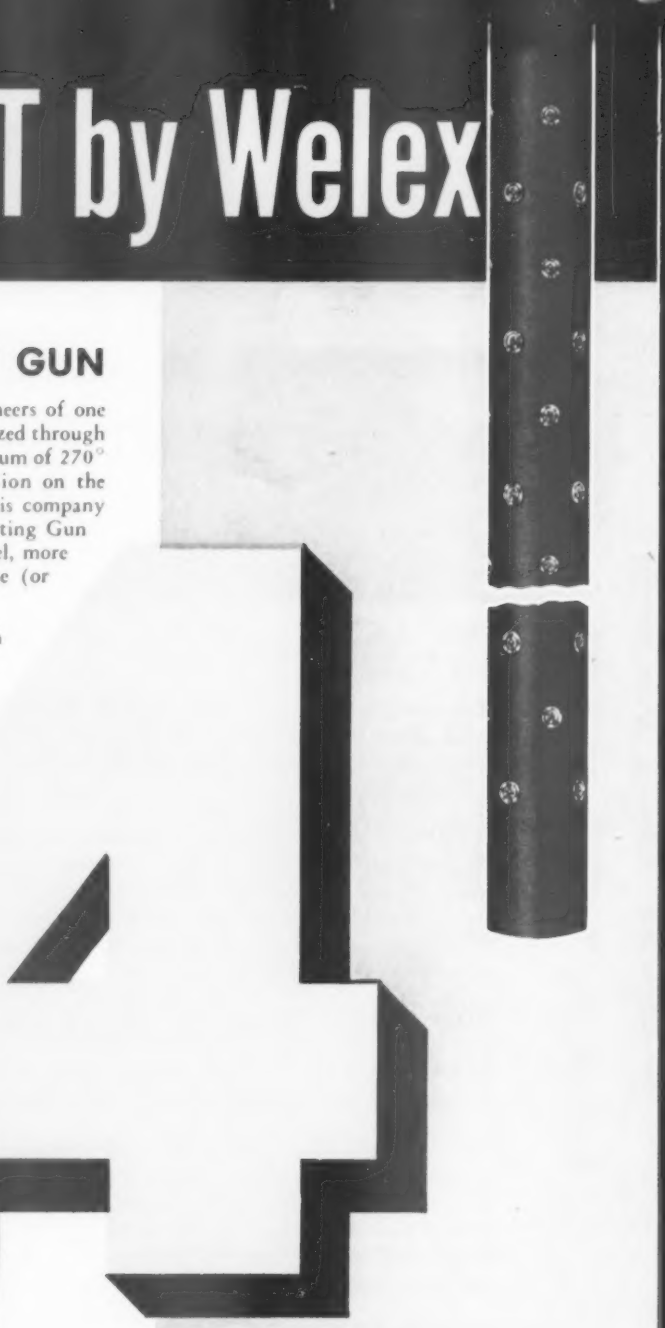
Another FIRST by Welex

THE WELEX FOUR-WAY JET GUN

Extensive research on squeeze cementing problems by engineers of one of the major oil companies, has disclosed that cement — squeezed through perforations — would cover a minimum of 45° and a maximum of 270° around the circumference of the pipe for each perforation on the same horizontal level. After these results were disclosed, this company requested Welex to consider the designing of a Jet Perforating Gun that would perforate more holes on the same horizontal level, more holes per foot, and would give complete cement coverage (or pancake effect) around the casing.

After extensive research and testing by the Welex Research Department, a Perforating Gun was produced that will perforate sets of four holes on the same horizontal level with as many as twelve holes per foot. This Four-Way Jet Gun has proven to be highly satisfactory after numerous tests in the field, as it offers a newly engineered hole pattern — together with the usual positive deep penetration. It offers a new, well balanced hole pattern with outstanding advantages that only the Jet Process can offer to the ever increasing problems confronting the oil industry.





It is the ultimate goal of Welex to provide the oil industry — at all times — with the latest and best in perforating methods.

"Call Welex and Be Sure"

ORIGINATORS OF Welex JET PERFORATING

Welex

This Four-Way Jet Gun can be used, with beneficial advantages, in the following completion methods:

1. Squeeze Cementing
2. Cementing channels behind casing
3. Support for casing
4. Acidizing
5. Production (Maximum density in thin zones)
6. Disposal wells
7. Hydrafrac
8. Plasticizing

JET SERVICES INC.
General Offices: 1400 E. Berry,
Fort Worth, Texas

They Say—

Tests Trace Cancer to Smog

"In a report based on 2 years of research . . . Dr. Paul Kotin, assistant professor of pathology at the University of Southern California, states that cancer was produced on laboratory mice by painting hydrocarbon substances extracted from Los Angeles smog on their skin.

"He added there is also enough evidence on hand to suggest that other mice, living in a room filled with normal concentrations of Los Angeles smog, had contracted lung cancer from the air pollutants.

"At the same time, he declared that the increase in lung cancer in the Los Angeles area over the past decades is without biological parallel in medical history.

"While industry is not entirely to blame for air pollution . . . industry must take the leadership in curbing air pollution. The health, happiness, and perhaps the survival of all of us depend on an appreciation across the entire industrial scene of the seriousness of the problem and a determination to curb air pollution at its source."

Eugene J. Houdry, president of Oxy-Catalyst, Inc., addressing the National Metal Decorators Convention, Chicago.

Journal Aids Both Big and Little

Dear Sir:

We at Security Oil & Realty Co. are taking this opportunity to express our views of the fine publications put out by your Oil and Gas Journal. We are just a small cog in the oil and gas business but expect to grow bigger in the future. The Journal is doing its part in guiding us in that direction.

We not only enjoy all the fine and up-to-date articles, but also think the advertising is very colorful and unique.

In short, we don't ever want to be without the Journal.

Thank you also for the fine map of the U. S. and Canadian crude-oil and products pipe-line systems.

F. C. Juds
Maadan, N. D.

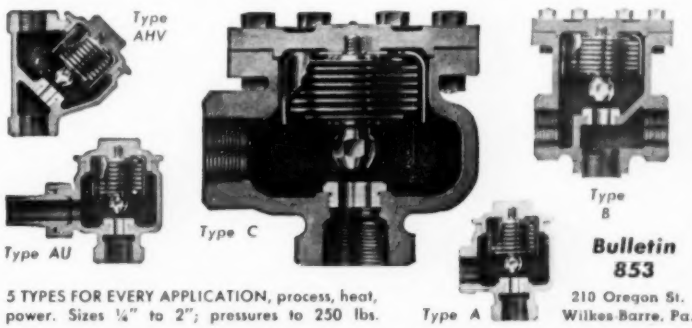
Federal Gas Tax Unjust to States

"Since World War II a general surge of highway building has been powered by federal matching funds. All the states have at least tried to build enough to use their share of the money allocated by the federal Government. It

NICHOLSON STEAM TRAPS

CUT HEAT-UP TIME 48%

A large processor recently reduced the heating cycles of cookers from 105 min. to 50-60 min., by substituting Nicholson thermostatic steam traps for a mechanical type. This effected a gratifying production increase of 37%. Reasons for Nicholson's faster heat transfer: operate on lowest temperature differential; 2 to 6 times average drainage capacity; maximum air venting. To learn why an increasing number of leading plants are standardizing on Nicholson thermostatic traps send for our catalog.



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Bulletin 853

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With GROUND THREADS

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- Made from heat-treated bars—(A.S.T.M. A193 Grade B-7).
- Threads *centerless-ground* to provide smooth finish unobtainable with most other production methods.
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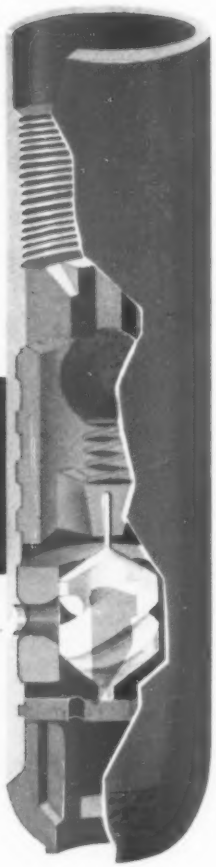
STUDS • THREADED BARS • STILL SCREWS • STAINLESS STUDS AND NUTS

ROTOR SPEEDS TO 3000 RPM
GIVE 3 IMPORTANT BENEFITS

with

HALLIBURTON'S TURBO JET



Controlled jetting action – with rotor speeds from 1200 to 3000 rpm – allows this vital new development in Halliburton's Floating and Guiding Equipment to provide three big advantages in well cementing...

1 *Jets mud cake off walls while rotating pipe.*
2 *Penetrates bridges encountered while running casing.*
3 *Floats and guides casing down hole smoothly.*

The aluminum rotor of this Turbo Jet Shoe contains two spiraled grooves that distribute about 40% of the fluid through ports at a 45° downward angle, and about 60% out through the end of the casing shoe guide. Rotor speeds depend on pump pressures and volume of fluid being pumped into casing.

Backed by million job experience and developed by men who know cementing best, the versatile Turbo Jet is designed to minimize channeling and provide more uniform, stronger cementing.

Be sure you get Turbo Jet – with Halliburton's Floating and Guiding Equipment – for your next job. Just call your nearby Halliburton representative. Or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

YEARS AHEAD IN FLOATING EQUIPMENT!

has been a very important influence but there is another side to the picture. The money sent back to the states is considerably less than the federal Government raises from its 2-cent gasoline tax.

"Why shouldn't the federal Government get out of the highway business and let the states have its 2-cent tax?

"A basic principle of road building calls for putting back on the highways all the money from taxes on highway use. Everything that can be raised from highway sources is needed for construction. Any kind of diversion of highway funds is inexcusable. A considerable part of the federal gasoline tax is diverted to other government purposes.

"If the Government does not relinquish its gas tax to the states it should return all the revenue to the states."

Editorial in the Kansas City Star.

Petrochems Making Big Gains

"Today, the petrochemical industry is producing about 25 per cent of all the chemicals made in the United States. Analysts in the industry predict that within another decade fully 50 per cent of the nation's total chemical output will come from petrochemical plants. The industry's sales in 1952 were $2.5 billion and, with new production facilities coming on stream, sales probably will reach $3 billion in 1953."

Gordon H. Turrentine, vice president of Texas National Bank of Houston, addressing a meeting of the New York Society Analysts.

Oil Is Blessing to Farmers

"The harnessing of petroleum power to their fields means that American farmers each year are increasing yield from each acre of land and each unit of livestock. And they are doing this despite a decreasing number of farm workers.

"I think it is important to point out, too, that power farming helps in the conservation of natural resources. Tractors powered by petroleum have made it easier for farmers to apply contouring, terracing, stubble-mulching, and other beneficial soil practices. The oil industry itself counts among its most important programs those aimed at the conservation of the natural resources with which it deals."

Frank R. Markley, vice president in charge of marketing for Sun Oil Co., on General Electric Co.'s farm forum radio program, Schenectady, N. Y.

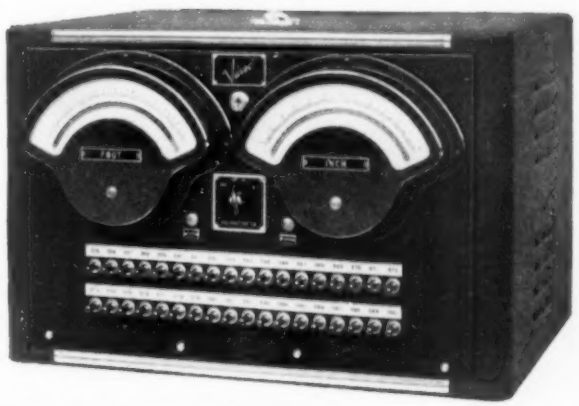
How to Destroy Business

"Unfortunately for us, dynamite and physical sabotage are not the only ways of destroying industry. They are in fact the poorer less damaging ways. Our industry can in fact be weakened

FAST—
ACCURATE—
SELECTIVE—
REMOTE TANK GAUGING

at the flick of a switch!...

FIGURE NO. 9200-R KEY SWITCH TYPE



"Varec" REMOTE READING TANK GAUGE RECEIVERS

This newly designed "VAREC" Tank Gauge Receiver is equipped with 36 key-type switches instead of the usual dial selector. Tank selection is positive and more rapid. Human error is reduced to a minimum because each switch is associated with its individual tank. The Receiver design is flexible permitting easy custom panel installations when desired. Tank numbers may be changed to suit user's convenience. This latest addition to the "VAREC" line of Electronic Gauger Systems is fully described and illustrated in Bulletin No. CP-3003.

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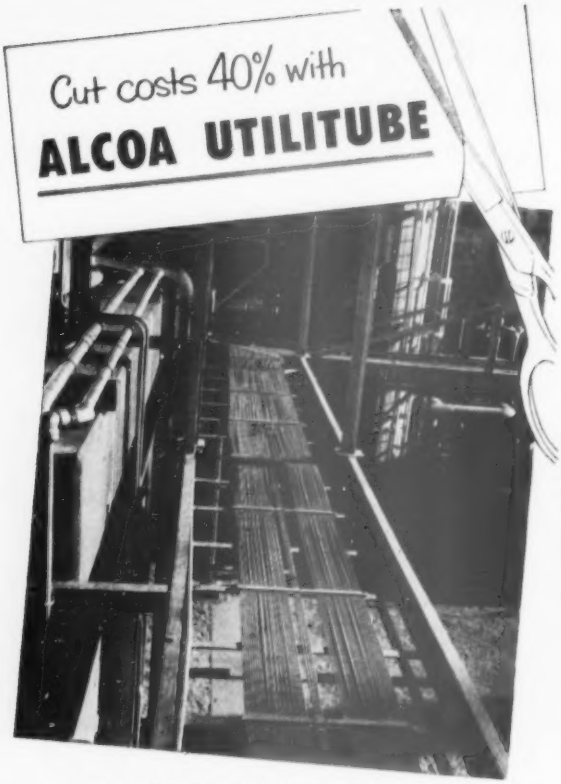
ALCOA UTILITUBE



36,000 feet of ALCOA Aluminum Coiled Tube serves air, dried by Alcoa *Activated** Alumina, to catalytic cracking unit at the Anderson-Prichard Oil Corporation, Arkansas City, Kansas. Partially exposed to hydrogen sulfide, tubing shows no corrosion, has required no maintenance since installation in September, 1952.

ALCOA UTILITUBE* is the lowest cost corrosion-resistant tube you can buy—up to 40 per cent less than other corrosion-resistant metals. It gives you 3 times more feet per pound. It is easier to form, flare and bend than annealed copper. It will not gum, sludge or discolor the fluids it carries.

ALCOA UTILITUBE comes in standard 50 and 100 foot lengths and in economical, long lengths up to 1,000 feet in some sizes.

ALCOA UTILITUBE is designed to handle fuel and lubricants in engines, air in instrument systems, fluids in hydraulic systems, cutting compounds in machine tools, etc. For complete information, write for the new booklet: "Alcoa Utilitube."

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Alcoa Aluminum

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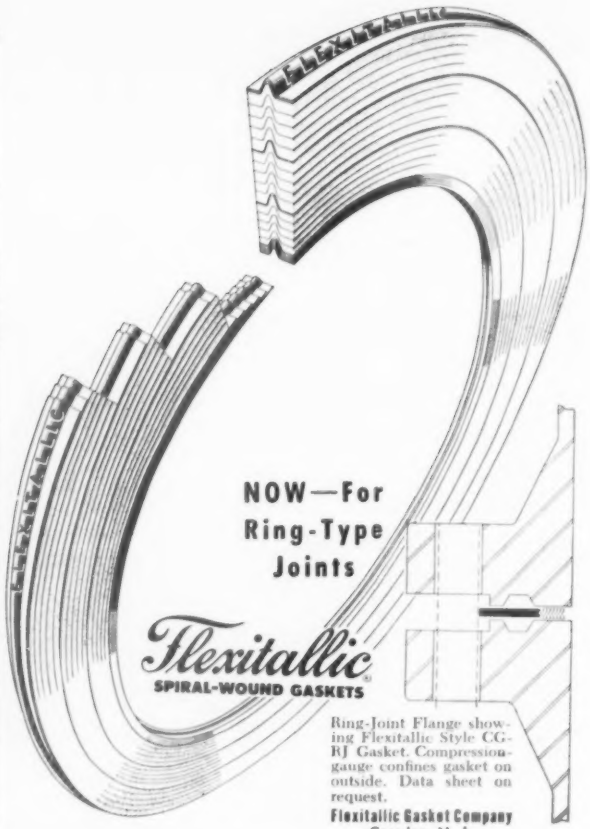

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more effectively by the far more subtle process of economic sabotage.

"Technology requires smooth and harmonious working relationships between management and labor. An effective method of disruption would be to obscure their understanding of each other by making it illegal for employers and individual employes to discuss labor matters of any kind. This was tried out once before, and it was found that it soon stopped discussion of anything between management and workers, greatly accelerating the growth of mutual hostility and suspicion. Putting the gas back into the employer's mouth would surely create all kinds of labor discord."

Henry B. duPont, vice president of the duPont Co., addressing the Kinston, N. C., Chamber of Commerce.

What Makes a Billion-Dollar Firm

"A significant milestone in the progress of our company was reached recently when our total assets crossed the billion-dollar mark.

"But a company is not great just because it is growing big. It grows big because it is great. The real significance of our sound and rapid growth lies in the planning, initiative, tireless effort and team work of our employes who pushed Phillips past this billion-dollar milestone; in the confidence of our stockholders who have supplied our capital; and in the support of customers whose loyalty has acclaimed the quality of our products.

"As I have often said before, our company's greatest asset is not measured in dollars and cents. This asset, our employes who have contributed to the accomplishments reflected in our growth, far outmeasures the billion-dollar book figure. As we continue the pioneering spirit, initiative, efforts and teamwork which have resulted in this brilliant record of achievements, we will pass many more milestones of progress."

K. S. Adams, chairman of Phillips Petroleum Co., in the company's publication Philnews.

CALENDAR OF EVENTS

OCTOBER

26-28 National Lubricating Grease Institute, Edgewater Beach Hotel, Chicago.

26-29 American Gas Association, annual conference, Kiel Auditorium, St. Louis.

27 Institute of Gas Technology, annual meeting, Chase Hotel, St. Louis.

27 Association of Consulting Chemists and Chemical Engineers, Inc., annual

Where you must have the Safety of a Burst-Proof Hose and the extreme flexibility that only Republic WIRETEX can give . . . a hose that will **safely** carry superheated steam up to 388° F. . . . then WIRETEX Steam Hose will meet your specifications —

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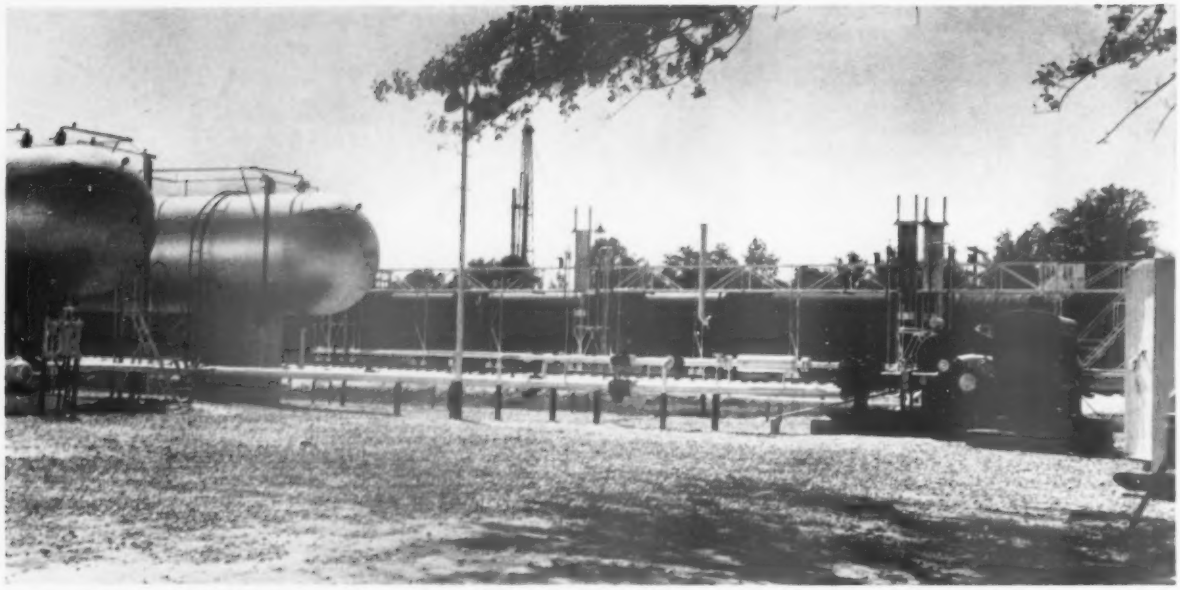


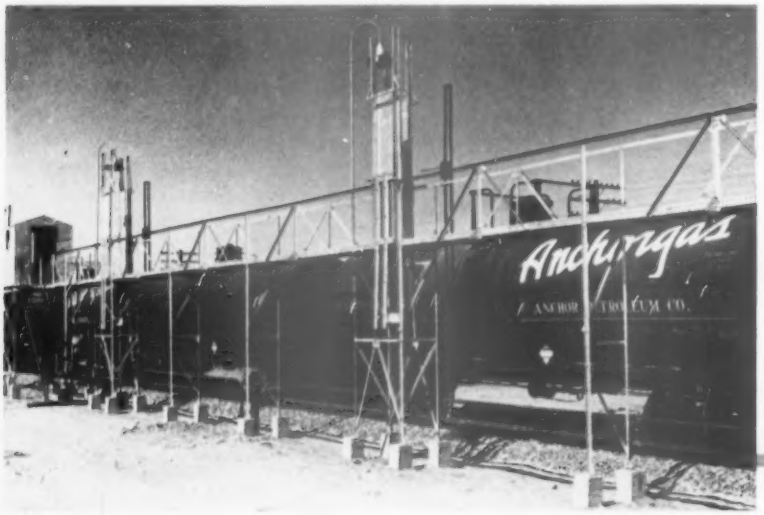
Anchor's Hattiesburg, Mississippi, Underground Storage Plant includes three large storage wells, truck loading terminal and tank car loading rack capable of loading 20 cars. Modern dehydration and testing equipment is being used in Anchor's Underground Storage projects to insure Anchor customers of the highest quality Butane and Propane.

Storage tank and electrical control panel with stop-start stations for pump and compressor . . . at Anchor's Midland, Texas, Underground Storage Plant.

Below: Anchor's Midland, Texas, Underground Storage plant, has a tank car loading rack capable of holding 10 cars.

Anchor Underground Storage

Right: Propane well at the Hattiesburg, Mississippi, Plant, showing Christmas tree, propane line and water line.



Anchor Underground Storage... Important to the Producer of LPG

With two Anchor Underground Storage plants in operation and the third storage plant underway in Bath, N. Y., Anchor Petroleum Company will substantially increase their storage capacities for LPG. This means that we have a place for your gas . . . winter and summer.

Anchor has the facilities . . . the tank cars, the outlets, the storage and the knowledge to handle your production with ease. You'll get a load off your shoulders when you turn your production to Anchor.

Anchor buys and sells LPG, Natural Gas and other Petroleum Products. Call 2-7261 and let's talk turkey.

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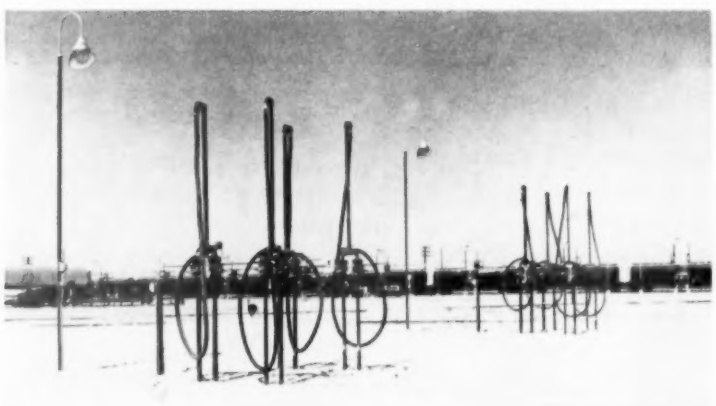
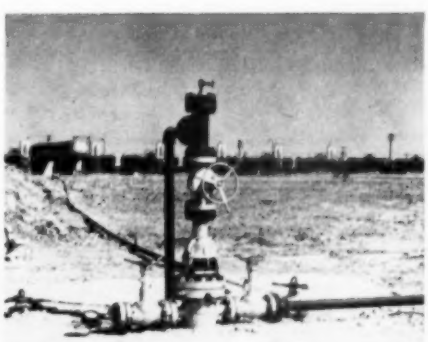


Anchorgas

The truck loading terminal at Anchor's Midland Plant is designed to load two different products at the same time.

Right: Gas is being pumped into one of Anchor's storage wells at Midland, Texas. Tank car loading rack is shown in the background.



Below: Truck loading and unloading rack at Hattiesburg. Will accommodate 4 trucks at one time.

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Galvanized Sheets

for PEAK PERFORMANCE

Engineers and designers of industrial and commercial buildings know galvanized sheets to be superior building material for this type of construction—particularly for roofing and siding. They know that time-tested galvanized sheets offer:

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  Low *initial* cost, low *application* cost, low *per-year* cost
- **STRENGTH OF STEEL; RUST-PROTECTION OF ZINC**
  Withstand rough treatment, add structural strength and are fireproof

All galvanized sheets give years of useful service. But the *heavier* the zinc coating, the *longer* the life of the base sheet. Because various weights of zinc coating look alike on the surface, it pays to *specify a grade-marked sheet* . . . Get the heaviest coating you can buy!

ZINC INSTITUTE 2 OZ. COATING REG U S PAT OFF SEAL OF QUALITY

IT'S THE ZINC THAT STOPS THE RUST

For long, rust-free service, specify a heavy duty sheet such as the "Seal of Quality" with a zinc coating of *2 ounces per square foot.* For heavier coatings order according to ASTM Specification A 93.

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meeting, Hotel Belmont Plaza, New York City.

28-30 Seventeenth Technical Conference on Petroleum Production, Mineral Industries Building, Pennsylvania State College, State College, Pa.

29-31 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

30-31 South Texas Geological Society, annual fall field trip, San Antonio.

NOVEMBER

3- 4 Society of Automotive Engineers, national diesel-engine meeting, Conrad Hilton Hotel, Chicago.

5- 6 Society of Automotive Engineers, national fuels and lubricants meeting, Conrad Hilton Hotel, Chicago.

5-6 American Association of Petroleum Geologists, Pacific section, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists annual joint meeting, Hotel Biltmore, Los Angeles.

6- 7 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

9-11 Geological Society of America, annual meeting, Royal York Hotel, Toronto, Ont.

9-12 American Petroleum Institute, annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

12-13 Society of Exploration Geophysicists, midwestern meeting, Adolphus Hotel, Dallas.

19-20 National Association of Corrosion Engineers, western region, fall conference, Biltmore Hotel, Los Angeles.

19-20 Annual Instrument Short Course, Los Angeles Harbor Junior College, applied technology division, Wilmington, Calif.

20 Natural Gasoline Association of America, regional meeting, Herring Hotel, Amarillo, Tex.

Nov. 29-Dec. 2 American Society of Mechanical Engineers, Statler Hotel, New York City.

DECEMBER

1- 4 Corrosion conference, University of Oklahoma, Norman.

13-16 American Institute of Chemical Engineers, annual meeting, Hotel Jefferson, St. Louis.

JANUARY

11-15 Society of Automotive Engineers, annual meeting and engineering display, Sheraton-Cadillac and Statler Hotels.

12-14 National Constructors Association, annual meeting, Hotel Commodore, New York City.

FEBRUARY

26 Natural Gasoline Association of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

MARCH

1- 5 American Society for Testing Materials, spring meeting, Shoreham Hotel, Washington, D. C.

3- 5 American Petroleum Institute, Division of Production, Southwestern district, Rice Hotel, Houston.

4- 5 American Gas Association, transmission and storage conference, Jung Hotel, New Orleans.

8-10 American Institute of Chemical Engineers, Statler Hotel, Washington.

17-19 American Petroleum Institute, Division of Production, Mid-Continent district, Skirvin Hotel, Oklahoma City.

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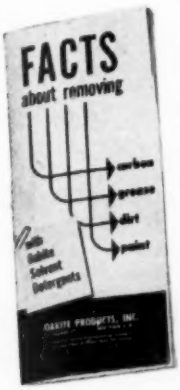

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THE OIL AND GAS
JOURNAL
TULSA, OKLAHOMA

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JOURNALLY Speaking

All Wrapped Up

DID you receive this issue of the Journal on time and in good condition? If so, our new wrapping machine is a success. If not, you can chalk it up to the difficulties of getting this intricate gadget into proper adjustment to do its stuff.

This wrapping machine is a modern mechanical monster that now dominates the space in our mailing department which formerly was filled with big tables at which girls stuffed copies of the Big Yellow Book into mailing envelopes. The new robot does away with envelopes and deftly encases each copy in a preaddressed manila wrapper.

This operation is not only faster than envelope stuffing, but should get the magazine to you in better condition. This may seem paradoxical at first, because the wrapper has no ends while an envelope gives protection all around. The explanation lies in the fact that the wrapper fits very tightly—much tighter than anyone could wrap by hand. As a result the wrapped magazine is almost as solid as a board.

Mail bags, you know, get pretty rough treatment in transit, and a magazine slides around in an envelope and often gets dog-eared and battered before it reaches its destination. A tightly wrapped book actually travels better. Just one more example of how we keep on improving the service to our readers.

Petrochem Progress

WHAT this industry needs is a package-deal petrochmical plant that an independent producer can hook up to his well and be in position to thumb his nose at the crude buyers.

For evidence, look at the special petrochemical section in this week's issue. It says there that turning crude into motor fuel increases its value only 2½ times, but turning it into petrochemicals increases the value 12 times. Also that $2,700,000,000 worth of petrochemicals was sold last year. And that only 1 per cent of our petroleum went into petrochemicals. Now if we would just turn the other 99 per cent into petrochemicals this would be a three-trillion-dollar industry.

Maybe that's fantastic, but it's not much more fantastic than some of the names in our list of chemicals that are being made out of petroleum today. This industry sure is branching out. For instance, we'll bet not one oil man in a thousand realized that Standard Oil Co. of California is in the n-Trichloromethylthiotetrahydrophthalimide business. Read the Journal and keep up to date.

Comics Intelligence

DO you keep up with the funnies, specifically Superman? A reader sends us a tear sheet depicting an episode in Superman's war against a pair of unprincipled characters from another planet who disguise themselves as earthmen and go into the oil business.

Like the old-time wildcatters they believe in the rule of capture, and they also improve on directional drilling by digging a tunnel from their land 500 miles to an "underground lake of oil." This causes all the wells in the next state to go dry instantly, while the two interplanetary wildcatters have themselves a gusher and a monopoly on the oil business.

The last picture shows Superman flying to the rescue. We missed the next Sunday's paper, but no doubt he disguised himself as a conservation commission and ordered a potential test, set an allowable, and enforced ratable take, thus settling the industry's troubles and ending the threat of an oil shortage.

But what interested our reader was the underground lake of oil. The picture showed it looking like a view of Mammoth Cave, with a dark blue river flowing placidly through it.

"All joking aside," he wrote, "this is exactly the concept that the average layman has about the occurrence of oil—at least the ones I know. I mention this to show that the effort to enlighten the public about the oil industry isn't a complete success."

—Henry D. Ralph.

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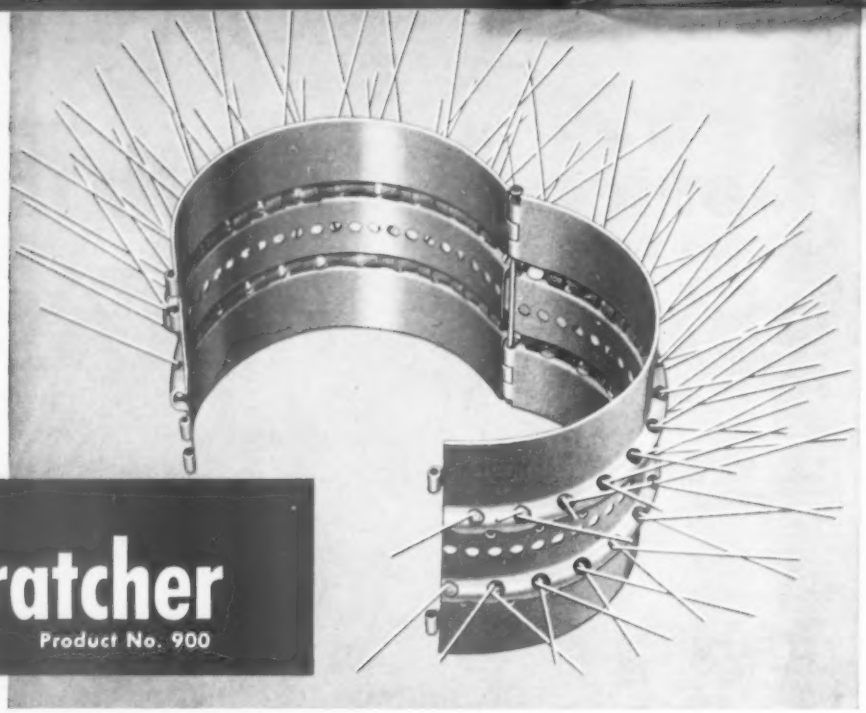
BAKER

Wall Scratcher

Product No. 900



for controlled removal of mud cake to obtain a better primary cement job

One of the most important operations in conditioning the wall of the hole for a primary cement job is the removal of mud cake throughout the intervals to be cemented. The Baker Wall Scratcher was designed specifically to perform that operation.

Hinged for easy installation, the Baker Wall Scratcher is equipped with two full rows of sturdy, spring-loaded scratcher wires that give complete 360° scratching coverage. Each pair of wires is crossed for greater strength in cutting the wall cake into small particles.

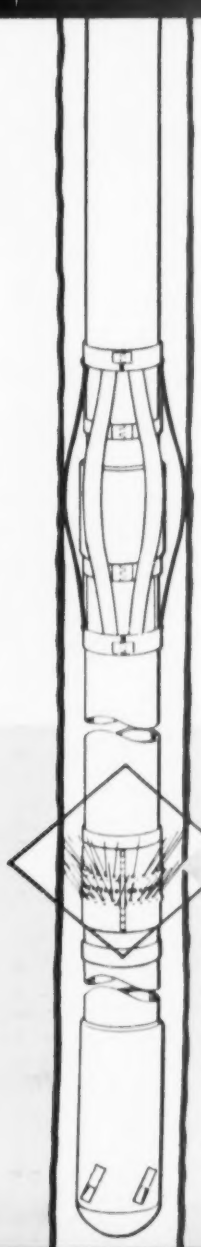
The scratcher wires are pitched upward so that the scratcher can, first of all, be run to scratching depth without causing any significant disturbance of the mud cake. This feature is even more important during the actual hole-conditioning operation, because the up-pitched scratcher wires dig more firmly into the wall cake and are forced into a position of maximum reach and scratching efficiency whenever the casing is raised more than the distance between Stop Rings.

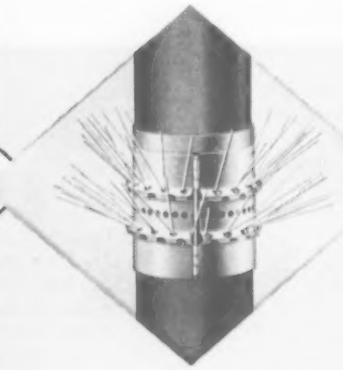
QUICK FACTS *about Baker Wall Scratchers*

1. Spring-loaded scratcher wires are pitched upward to dig firmly into mud cake with maximum reach and scratching efficiency on the upstroke during scratching operation.
2. During down-hole travel, up-pitched scratcher wires ride easily along surface of well bore and minimize scratching action.
3. Mud cake remains undisturbed until casing is raised more than distance between Stop Rings.
4. Scratchers reach scratching depth in good condition, with scratching efficiency unimpaired by excessive distortion of wires and springs.
5. Two rows of sturdy scratcher wires, crossed in pairs, assure full 360° scratching of more surface at each stroke; cut wall cake into smaller particles.
6. Scratcher wires are available in two lengths to meet the specific needs of slim-hole or regular programs.
7. Hinged for rapid, easy installation.

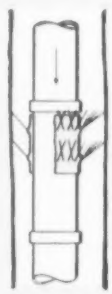
BAKER OIL TOOLS, INC.

HOUSTON • LOS ANGELES • NEW YORK



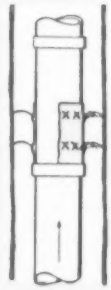


Here is how controlled scratching works →



During down-hole travel, the up-pitched scratcher wires ride easily along the surface of the well bore so that no significant disturbance of the mud cake will result.

When the casing is lifted up out of the slips during the running-in operation, no scratching action occurs. Scratcher remains stationary until contacted by Stop Rings.



On each upstroke during the actual scratching operation, the crossed pairs of up-pitched scratcher wires dig firmly into the mud cake with maximum reach and scratching efficiency.

Imports are threatening to undermine proration

IMPORTS of petroleum are fast threatening to break down the system of market-demand proration in the United States. This is the system by which production of crude oil is kept roughly in balance with demand, thus stabilizing prices and avoiding aboveground physical and economic waste.

During the past score of years proration has functioned reasonably well because the states producing the major part of the nation's crude evolved methods for forecasting supply and demand and for adjusting production to fit, not precisely but within limits which prevented serious surpluses and shortages.

That portion of crude supply, including imports, not subject to proration was enough to keep the market competitive but not enough to upset the balance disastrously. Relatively small periodic percentage changes in prorated supply accomplished the result.

NOW imports have become such a large part of total supply that it is increasingly difficult to maintain a balance with demand by adjustments in the prorated portion. Not only is it impossible to control imports, it is almost impossible to forecast them.

There are only two ways out: (1) Either bring imports under proration or some other device which has a similar effect, or (2) do away with proration of part of the supply and have completely unrestricted competition in the crude market.

Proration has its critics, including many producers. But it is generally agreed that proration has prevented "feast and famine" cycles, contributed to a fair and stable price structure, maintained proved reserves, and made oil in the ground a bankable commodity.

SOME foreign oil is needed in the United States. How much may always be a matter for argument, just as there always are arguments over how much any domestic area should produce in a given month. If a supply-demand balance is a desirable objective—as proration assumes—then there must be some degree of predictability and rationality in imports.

It is patently unfair to ask those producers subject to proration to curtail output drastically while others are unfettered. A market can't exist half controlled and half free.

Furthermore, regardless of fairness, it will be impossible to balance supply with demand if the portion of supply subject to proration becomes too small a percentage of the total. That point may not be here yet, but it could come. But before it comes, controlled producers might rebel and demand a completely free market regardless of what happens to prices and reserves.

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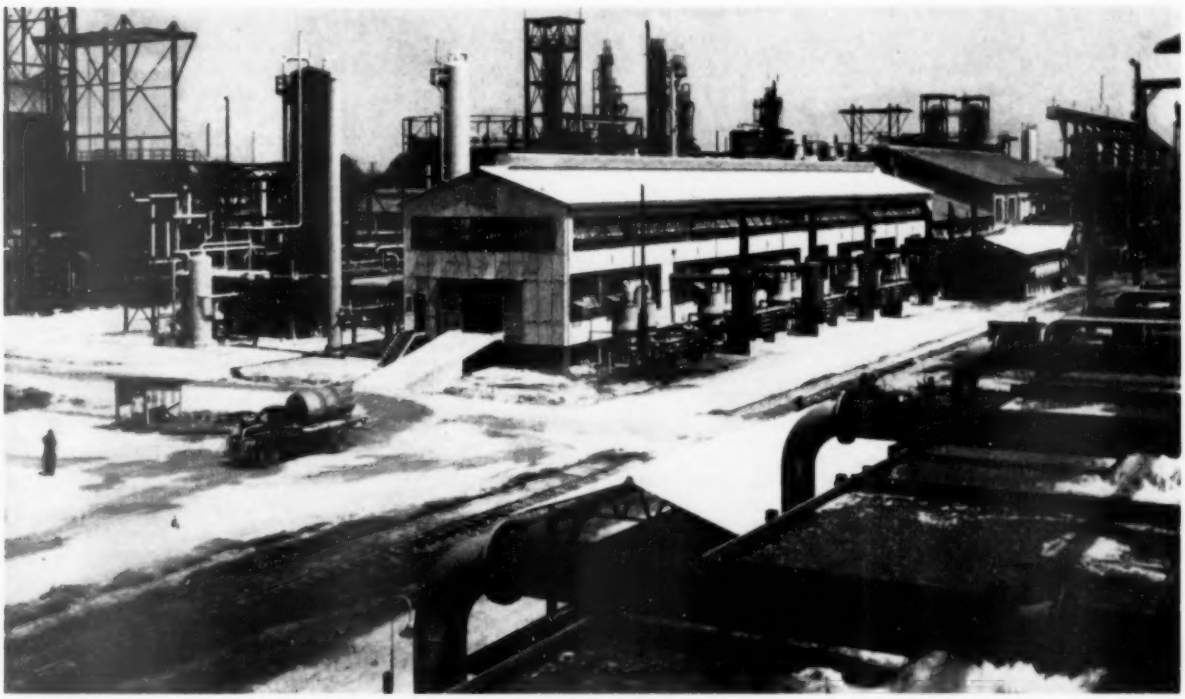
THIS WEEK... ...IN THE NEWS



DOUBLED IN SIZE, this Commercial Solvent Corp. plant in northern Louisiana now produces 30,000,000 gal. of synthetic methanol and 140,000 tons of anhydrous ammonia a year from natural gas. The Monroe field originally furnished gas for the manufacturing processes, but the $20 million expansion program made it necessary to tap other gas fields in Louisiana and Texas. The plant employs the first commercial application of the Stengel process. For further details on the plant expansion see page 68.

PETROCHEMICALS—Estimates of this year's output indicate 1 of every 4 lb. of chemicals manufactured in 1953 will originate from petroleum and natural gas. . . . The temporary slump in organic aliphatic chemicals last year appears to be offset by recoveries this year in key chemicals. . . . ¶The Sterlington, La., plant of Commercial Solvent Corp. doubles its capacity for production of methanol and anhydrous ammonia from natural gas. . . . The expansion program represents an outlay of $20 million. . . . ¶Partial oxidation with oxygen for making synthesis gas is a process that is creating a new trend in the field of petrochemicals. . . . At least three new plants now under construction will use this process. . . .

INTERNATIONAL—Iraq Petroleum Co., Ltd., completes 65-mile, 24-in. products line from Zubair field to Persian Gulf terminus at Fao as part of a program to increase production in Iraq. . . . ¶Arabian American Oil Co. continues operations as 13,000 Saudi Arabian workers stage walkout. . . . ¶Herbert Hoover, Jr., arrives in Teheran on fact-finding mission for U. S. State Department concerning the British-Iranian oil nationalization dispute. . . .

PIPE LINES—PAD sounds out gas industry executives on construction of a large-diameter Gulf-East Coast gas pipe line which could be converted to move oil products in emergencies. . . . Completion of the Trans Mountain pipe line results in cuts in products prices in British Columbia. . . . ¶International Pipe Line, Inc., plans construction of a 132-mile, 8-in. products line from the new 11,500-bbl. International Refineries, Inc., refinery at Wrenshall, Minn., to proposed storage and terminal facilities at Minneapolis.

REFINING—Sinclair completes expansion of Houston refinery enlarging crude-charge capacity from the former 90,000 bbl. daily to 125,000 bbl. daily. . . . New facilities include 50,000-bbl. fluid cat cracker and new distillation units. . . . ¶Construction starts on 15,000-bbl. cat reformer at General Petroleum Corp.'s Torrance, Calif., refinery. . . . ¶Short-cut method for determining quickly the approximate cost of building a process unit described to A.I.Ch.E.

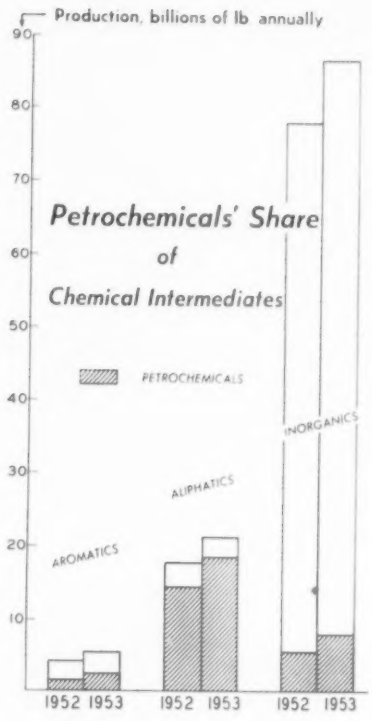
ACTIVITY—Production of crude and lease condensate averaged 6,284,400 bbl. daily for week ended October 17, down 12,050 bbl. daily. . . . ¶Total well completions dropped 46 wells for the week to 1,013. . . . ¶Wildcat completions totaled 187, compared with 251 for previous week and 187 for same week last year. . . . ¶Total rotary rigs operating in the United States increased 57 rigs for week ended October 19 to 2,760, a record for this year. . . .

TRENDS—Refinery runs for 5-week period ended October 17 averaged 262,000 bbl. daily less than for the preceding 5 weeks. . . . Additions to major product storage were cut 615,000 bbl. daily in the last 5 weeks compared with the earlier 5-week period. . . . The difference between the cut in stock accumulation and the reduction in runs indicates a seasonal increase in total product demand. . . .

28.9 Billion Pounds of Petrochemicals . . .

. . . Will Be Produced This Year in Form of Chemical Intermediates, Survey Shows

- Petrochemicals output will comprise 25.5 per cent of total chemical intermediates production.
- Aliphatics, aromatics, inorganics production to show marked gains.



George Weber

ONE pound of chemicals out of every four manufactured this year will originate from petroleum and natural gas.

Preliminary estimates of current domestic petrochemical production indicate that its share of the total chemical market will slightly exceed 25 per cent.

In all three major classes of chemicals, those derived from petroleum and natural gas will show percentage gains this year. Aliphatic organic chemicals, the largest petrochemical group will show substantial recovery from the slump of 1952. In most key chemical intermediates of this class, current production rates have risen well over the record-high output of 1951.

Although relatively small tonnagewise, petroleum aromatics will continue the growth trend previously projected. Continued commission of new catalytic reforming and aromatics-recovery facilities in United States refineries this year account for a substantial jump in this class. The three basic petrochemicals which comprise the inorganic group will further increase their percentage share of total inorganics, however small.

The temporary slump in organic aliphatic chemicals last year, appears to be more than offset by current recoveries in most of the key chemicals. Actually, although the output of basic aliphatics last year was about 11 per cent off from 1951 production, the combined effect of continued increases in the aromatic and inorganic petrochemicals resulted in a gain of about 5 per cent of 1951 in total basic chemicals from petroleum and natural gas.

Preliminary estimates of this year's activity in petrochemicals intermediates are compared with 1952 totals in the accompanying table.

ESTIMATED 1953 PRODUCTION

	Est. production (billions of lb.)	
Chemical group	**1953**	**1952**
Synthetic organic chemicals:		
Aliphatics:		
Total all intermediates	21.1	17.8
Petrochemical	18.6	14.6
% petrochemical	88.0	82.0
Aromatics:		
Total all intermediates	5.5	4.2
Petrochemical	2.6	1.7
% petrochemical	47.0	40.0
Inorganic chemicals:		
Total all intermediates	86.6	78.0
Petrochemicals	7.6	5.4
% petrochemical	9.0	7.0
All chemical intermediates	113.2	100.0
Petrochemicals	28.9	21.7
% petrochemical	25.5	21.7

Basis for estimates . . . When discussing statistics of this sort, it is necessary at the outset to call one's shots and define what kind of chemicals are involved. Unless clearly defined, figures on "total chemicals" can be misleading. Further, there exists a strong tendency toward duplication and pyramiding when putting chemical production figures together.

The above estimates pertain in nearly all cases to the production of chemical intermediates as distinguished from crude chemicals and finished products. This follows the procedure used by Bateman and Field (see page 102) in evaluating the production of petrochemicals for 1952. Their figures for last year's output of intermediates are quoted directly, and form the basis for estimating the current year's production.

The rough estimates drawn for 1953 petrochemical production are obviously subject to some error. They may be considered valid when so qualified, and are presented to indicate trends rather than to pinpoint production forecasts. In all cases maximum use is made of monthly reports from the U. S. Tariff Commission, the Bureau of Census, the Bureau of Internal Revenue, and the Bureau of Mines. Available production figures for the current year on key chemicals are compared with like periods of 1952, and individual estimates are modified in the light of recent demand trends, new productive capacity and other pertinent factors.

Aliphatics . . . Comprising the largest group of petrochemicals from the standpoints of tonnage and number of

chemicals, the aliphatics are the most difficult to estimate. A fairly accurate compilation based on detailed studies of past years is possible when considering 15 important intermediates *(U. S. Tariff Commission figures on synthetic organic chemicals, and monthly report of Alcohol & Tobacco Tax Division, Bureau of Internal Revenue)*. Some, like isopropanol, ethylene and propylene glycols, ethylene dichloride, formaldehyde, acetic anhydride, and acetone are now synthesized wholly or largely from petroleum basics. The petrochemical content of others varies widely.

Judging from all available data at this time, it appears that the entire aliphatic group will show substantial production gains over 1952, exceeding to a smaller extent, the output of 1951. Petrochemicals will contribute an increasingly large share of the crude chemicals going into these intermediates.

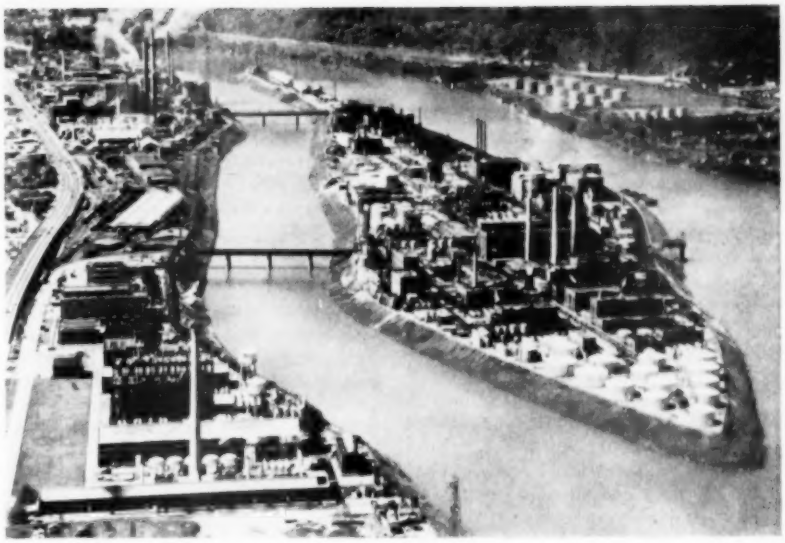
Two contrasting trends are seen in aliphatic production this year. The most important is the revival of the intermediates going into the manufacture of acetate fibers. Acetone, acetic acid, and acetic anhydride showed substantial output losses last year. The recovery in acetates, which started in the third quarter of 1952, was not sufficient to offset earlier declines. This year, however, continued increases in demand for this synthetic fiber class will account for very marked upturns in the production of the three principal intermediates contributing to that segment of industry.

The antifreeze market shows an opposite trend this year. Two relatively mild winters have resulted in sizable holdovers of stocks of both glycol and alcohol types, and production has been cut this year correspondingly.

The long-term trend in antifreeze has been toward the permanent type, based on ethylene and propylene glycol. Significantly, these two intermediates, and to a lesser extent, synthetic methanol, showed the only 1953 declines in production, based on the first 7 months of this year compared with a like 1952 period. It appears likely that both glycols will wind up 1953 with about a 10 per cent aggregate decrease from 1952 production.

Methanol appears to be in better shape at present. While it has lost ground to the permanent-type antifreezes over the past 3 years, there is a feeling in the market that further inroads may bring about adjustments this year, which may halt the trend.

New methanol outlets . . . Losses in the antifreeze end use of methanol have been offset to a marked extent by new outlets. The principal one, promising long-term growth prospects, is conversion to formaldehyde for phenolic resin and adhesive manufacture. Other end products such as pentaerythritol contribute to a firming future picture for methanol. Demand is still rising steadily in these fields *(U. S. Tariff Commission figures on production and sales of synthetic plastics and resins)*.



FIRST TRULY PETROCHEMICAL plant, established at South Charleston, W. Va., in 1925 by the forebears of Carbide & Carbon Chemicals Co., has long since outgrown its original site. The expansion of the plant spread it from the Kanawha River island site and along the river shores. The plant converts natural gas, petroleum fractions and other raw materials into hundreds of chemicals.

It appears that these newer potential outlets, coupled with the indication that methanol producers intend to hold the line on antifreeze uses, will contribute to long-term increases in methanol production. Although production for the first 7 months of 1953 was about 1 per cent off from that of a like period last year, the completion of new production facilities later in the year and the firming outlook are expected to offset the slow start. The current year's output is forecast by some at about 10 per cent over that of 1952.

The production of tetraethyl lead and the halogenated hydrocarbons which go into antiknock blends shows a firm projection both now and for the foreseeable future. In a number of other aliphatic intermediates of major tonnage, petrochemicals are gradually replacing crudes originating from electrolytic, fermentation, and other agricultural sources. This holds for some of the intermediates for synthetic fibers and potentially for synthetic rubber. Although government-owned rubber facilities are now partially based on alcohol butadiene, it is probable that when and if these facilities are transferred to private industry, the economic advantages of petroleum butadiene will result eventually in a complete conversion to that basic.

Hence, the current estimated 88 per cent share of aliphatic production enjoyed by petrochemicals should show further future gains, eventually approaching 100 per cent.

Aromatics still climbing . . . Some forecasters show less optimism in viewing the long-range prospects for petroleum-based aromatics. Within the next decade it is conceded that coal hydrogenation for chemicals may reverse the present trend.

For the current year, however, and for some time to come, it appears that growing demands for the three aromatic basics—benzene, toluene, and xylenes—must be met by increased synthesis from petroleum fractions. Petroleum benzene is more costly than byproduct benzene from coal-coking operations. But sustained high demand must continue to be met from the oil industry, since productive capacity based on coal is relatively inflexible.

Production of benzene, toluene and xylenes, from partial 1953 reports *(U. S. Tariff Commission on synthetic organics)*, is up about 30 per cent. Some gains in coal-based chemicals will be registered, but petroleum will account for most of the increases, contributing nearly half the current year's production. Data on aromatic intermediates such as aniline, phenol, and styrene are not sufficient for use in projecting current production, hence the available data on basics is consid-

ered valid enough to project to the intermediate class. When cumene-based phenol comes into increased production next year, the petrochemical share of intermediates will loom greater than the percentage obtained solely from the three basics recovered from catalytic reformates.

Steady growth in inorganics . . . A study of incomplete 1953 production reports (*"Facts for Industry," Bureau of Census, Department of Commerce*) for 10 key inorganic intermediates indicates a gain of about 10 per cent over 1952 output. The petrochemical share in this major tonnage group is relatively small, comprising synthetic anhydrous ammonia, sulfuric acid from petroleum sulfur, and carbon black.

Of the three, carbon black indicates a modest 2 per cent increase in production.

The various furnace blacks continue to gain at the expense of contact blacks. Last year, when production declined slightly from 1951, furnace blacks comprised about 65 per cent of total tonnage, while this year it appears that that type will account for close to 72 per cent of total carbon-black production. Underlying this transition is a trend away from natural gas, favoring wider use of heavy liquid fractions available from refineries. Aromatic-rich extracts from solvent treating of heavy stocks are ideally suited for carbon-black manufacture, and other residual fractions are finding increased demand for furnace-black manufacture.

Reflecting a major program of sulfur recovery from natural and refinery gases, production of petroleum sulfur for the first half of 1953 was up 50 per cent from the same period of 1952. The final returns for the full year will show less gain. Many new facilities came on stream during the third and fourth quarters of 1952, and the "first round" of construction for sulfur recovery had essentially run its course by mid-1953. Potential recoverable sulfur from hydrogen sulfide present in natural and refinery gases is well in excess of present production. However, the sulfur shortage of 2 and 3 years ago has been largely alleviated by new Frasch capacity, and the major sources of petroleum sulfur have already been tapped. It is likely that for the next few years the increase in petroleum sulfur production will be modest by comparison with the past two.

Huge ammonia growth . . . Ammonia on the other hand appears to present a continuing growth trend with natural gas contributing nearly all of the projected production increases. Some economists contend that synthetic anhydrous ammonia capacity now building or planned will catch up with projected demand within the next 2 years. Well-founded demand estimates made in the recent past have many times fallen short of the consumption which actually developed.

For direct soil fertilization and for conversion to solid fertilizers, ammonia shows strong growth possibilities for the extended future. It is generally conceded that this important basic will figure largely in the trend toward obtaining higher agricultural yields. Some factors affecting ammonia demand can be unpredictable. Acreage controls on major agricultural products, for example, tend to bolster demand. If limited in the acreage he can plant to a certain crop, the farmer tends to resort to heavier fertilization for increasing yield at a supported product price.

The conversion of ammonia synthesis from coke hydrogen to natural-gas hydrogen has been phenomenal throughout the postwar period. This trend took an accelerated turn this year, due to the conversion of two major plants from coke to natural gas, and to a lesser extent, to the continued building of new capacity based on natural gas. Last year, four of the five largest ammonia plants were based on hydrogen derived from coal coke. The conversion of the South Point, Ohio, and Hopewell, Va., plants by Allied Chemical & Dye's Nitrogen division swung a large segment over to the natural-gas side.

As a result, the two plants remaining on coke, plus several smaller installations based on electrolytic hydrogen, will have produced a little over 20 per cent of total synthetic ammonia for the current year. Contributing less than 7 per cent prior to World War II, natural gas has grown to dominate this field. Representing the largest tonnage petrochemical, synthetic anhydrous ammonia is an important contributor to the gains indicated for 1953 which should bring that segment's share of total chemical production to about 25 per cent.

Journal Names Petrochem Editor

JOHN C. REIDEL has been appointed petrochemical editor of The Oil and Gas Journal.

The appointment recognizes the continuing growth of this field of petroleum-industry activity and assures for Journal readers an even greater coverage of its developments.

Reidel has been with the Journal since 1949 and has a background of petrochemical, petroleum-refining, and writing experience.

A 1938 graduate of the Illinois Institute of Technology with a B.S. degree in chemical engineering, Reidel joined the Barrett Division of Allied Chemical & Dye Co., Chicago. He returned to Illinois Institute for graduate work and received his master's degree in 1941 in chemical engineering with a petroleum refining option.

In 1941 he joined the Petroleum Experiment Station of the Bureau of Mines at Bartlesville, Okla., working on the government's aviation-gasoline program. He left the bureau in 1942, serving in military duty with the technical inspection branch of the petroleum section of the Army's Quartermaster Corps.

In 1945 Reidel joined Victor Chemical Co., Chicago, as a process chemical engineer in the process-development department, leaving in 1946 to join the refining division of Bechtel Corp., San Francisco, as a process design engineer. He later was a design engineer with Parsons Co., Berkeley.

JOHN C. REIDEL

Reidel joined the Journal in 1949 as a district editor. Since 1950 he also has been adjunct professor in chemical engineering at the University of Tulsa. His latest major contribution to the field of petrochemical publishing, a 16-page survey of North American petrochemical plants, appears in this issue beginning on page 85.

Quicker Cost Estimating

Short-cut method of figuring cost of building refinery process unit described by Blaw-Knox engineer-contractor

F. Lawrence Resen

GALVESTON.—A short-cut method for determining quickly the approximate cost of building a process unit was described here October 15-16 at the eighth annual meeting of the South Texas section of the American Institute of Chemical Engineers.

The method was developed by J. F. Gilmore, Jr., Blaw-Knox Co., Tulsa, with data obtained from a study of detailed cost estimates of various sizes and types of processing plants and the actual costs of completed plants.

Basically, Gilmore's method involves obtaining the cost of the principal items of equipment, which usually can be done easily, then establishing a ratio or percentage of cost of all other items to the cost of the principal equipment.

These other items, as classified by Gilmore, are tangible material, direct field labor, intangible material and labor, engineering, and the contractor's overhead and profit.

Principal equipment . . . Principal items of equipment, Gilmore said, include vessels, heat exchangers, pumps, compressors, prime movers, heaters, blowers and fans, cooling towers, instruments, main supporting structures, buildings, electrical equipment (starters and push buttons), freight, and miscellaneous mechanical devices (elevators, hoists, cranes).

"Tangible" or "other material" specifically covers piping, structural, electrical, insulation, painting, and miscellaneous material requirements for the plant.

Piping-material cost is placed by Gilmore at 16.0 per cent of the cost of the total principal items. This includes cost of all process, compressor, fuel gas, water, air, steam, drainage, and relief pipe, valves and fittings, and of some shop-fabricated alloy piping.

Structural materials, including concrete (the biggest item cost-wise in the category), reinforcing steel and form lumber, supports, platforms, anchor bolts, and similar items, come to 4.6 per cent.

The electrical-material cost estimate of 3.6 per cent includes both construction supplies and labor, since, Gilmore said, electrical labor is one phase of construction which in most instances can best be performed by an electrical subcontractor. Two other such jobs in which labor cost is lumped with material cost are insulation, figured at 6.3 per cent, and painting, 1.2 per cent. Miscellaneous material, including such things as crushed rock for paving, and expansion joint material, comes to 0.5 per cent, he said.

Labor . . . Cost of direct field labor generally averages about 26.0 per cent of the total principal items. This includes cost of all manual and craft labor to perform excavation, concrete work, structural steel and equipment erection, instrumentation, field pipe fabrication, inspecting, and testing. It does not include labor required for temporary facilities, equipment, and general supervision. This is a part of the total indirect costs, calculated at 18.0 per cent.

Engineering . . . Here is included the established costs of engineering, overhead, fee, and contingency (protection for contractor in case of omissions or errors in his bid, unfavorable weather conditions, and variations in the efficiency of field labor). This percentage factor, which Gilmore takes not on the principal items but on the total direct and indirect cost, normally ranges from 15 to 30 per cent. The percentage is dependent upon or varies with the contractor, the competition, risks involved, location, information available, familiarity with the type of job, and the time allowed for the estimate.

The short-cut estimate, Gilmore said, can serve as a time-saving guide to those in the refining and chemical industry other than the contractor. For the contractor it may serve as an orientation figure, but it can by no means replace the detailed cost estimate which the bidding contractor must make. It should be understood, he said, that the degree of accuracy of the short-cut estimate depends upon the skill and judgment of the estimator.

Materials-cost estimating . . . A working guide for estimating the cost of materials of a fluid catalytic cracking unit was featured in a paper presented by Harold Bottomley, petroleum process consultant, Tulsa.

Bottomley said an investigation of the material costs of five such units with total costs ranging from $1,300,000 to $1,800,000 resulted in the following breakdown: Heaters (air), 0.8 per cent of total cost; vessels, 24 per cent; pumps and blowers, 17.8 per cent; tubulars, 7.2 per cent; piping (shop fabricated over 2-in.), 22.6 per cent; structural (shop fabricated), 4.6 per cent; special equipment, 1.7 per cent; foundations and earthwork, 3.5 per cent; instruments, 6.8 per cent; electrical, 3.4 per cent; insulation and fireproofing (subcontracted), 6.2 per cent; buildings, 1.3 per cent; and painting, 0.1 per cent.

Cost estimates, Bottomley said, are either detailed or of the "horseback" or curve type. The former require that the process scheme be fixed, a heat and material balance prepared, all equipment sized as to duty and capacity, and a great amount of preliminary engineering work completed. The curve estimates are largely for sales or talking purposes. These, he said, should be used with extreme caution. If the estimate is either appreciably too low or too high, the engineering contractor's reputation will suffer, and he may even lose the contract. Quick estimates generally should not be made unless they are absolutely necessary, Bottomley said.

Economic analysis important . . . Whether a refinery is showing a large profit, merely scratching along, or going out of business is largely dependent on economic analyses of its operations, according to H. P. Hamilton, Humble Oil & Refining Co., Baytown, Tex.

The analysis can be used to evaluate various raw materials as refinery charge stocks, to set prices of products, to choose the most economical refining operations using new or existing equipment, and to select projects for inclusion in research programs.

Although such analysis is one of the most important functions of refinery operation, it also is one of the most difficult, Hamilton said, since several hundred different products may be produced in a modern refinery from the one basic raw material, crude oil.

To carry through a thorough analysis of an economic problem in a refinery, Hamilton said, the analyst should:

. . . define the problem as completely as possible.

. . . establish a material balance which represents the net effect on finished or unfinished refinery products and charge stocks for the problem involved.

. . . assign products values and raw stock costs to the material balance.

. . . include operating costs.

The economic answer may appear in the form of feed stock value, product cost, or economic credit.

Purpose of analysis . . . There are four basic purposes for economic analyses in chemical plants, A. B. Horn, Ethyl Corp., told the symposium in a paper prepared jointly with F. J. Sergeys and W. C. Strader, also of Ethyl.

These are to guide: (1) research efforts, (2) judgment of management on capital expenditures, (3) establishment of pricing policies, and (4) cost control.

Factors which should be considered in making such an evaluation, Horn said, are costs of manufacturing, storage, packaging, and freight, sales expenses (including salaries, operating expenses, and commissions of sales personnel selling the product as well as costs of customer technical services and advertising), cost of supporting research, and capital required and its cost.

The cost of supporting research is the item most frequently overlooked, he said, in estimating the cost of producing a new product. It is highly unusual at present, he said, when research can be terminated on a product because the plant to produce it is under construction.

As guide to research . . . The first step, when making an economic analysis of the possibilities of manufacturing a newly developed product, is to establish some idea of its sales value and potential sales volume, Horn said. With this information, it will be possible to set a sales price or range of prices, with a relatively high price for a noncompetitive product scaling downward to an ultimate price based upon large-scale production or competition or both. With the price set, a sales expense estimate can be made—high or low depending upon whether the product will be sold in considerable volume and serve in the heavy chemicals' field or whether it is a specialty product or one which will invade a highly competitive field. It will also be necessary to forecast what continuing research expenditures will be required.

With the sales price and supporting expenses established to provide some idea of the amount of money which the product will bring in, the analyst can begin to estimate manufacturing costs.

One of the most important manufacturing variables is raw-material consumption. Here, with virtually no process information available, the economic evaluation serves as a guide to the research lab in setting the yield level which must be obtained to assure that the new product or process will be economically attractive.

As guide to management . . . The evaluation also can serve as an aid to management in its decisions on capital expenditures and pricing. By making a detailed analysis of anticipated manufacturing costs and combining this with the research, sales, and handling costs, an expected monetary return can be determined. The manufacturing costs hardest to anticipate accurately in making an evaluation of a new process are those for maintenance labor and materials. The effort here should be directed to relating maintenance costs of the new process to those in a similar operation.

New Flood Tracers

Anions of iodine and bromine used successfully in field tests to detect channeling, map progress of flood front

Joseph A. Kornfeld

BARTLESVILLE, Okla. — Iodine, bromine, and copper have been used successfully to trace movement of flood water in several Mid-Continent sandstone reservoirs.

Speaking before the seventh annual trisectional meeting of the American Chemical Society here October 17, A. W. Garst and B. B. Woods, research chemists with Stanolind Oil & Gas Co., Tulsa, said results of the experiments have shown that halide anions are the most promising tracer materials. These, the authors said, aren't readily lost through underground water movements. This conclusion is supported by recent studies by other researchers who used boric acid successfully as a tracer.

How tests were conducted . . . Before the field test was initiated, the concentration of naturally occurring iodine in formation water was determined in the laboratory to be 5 p.p.m.

Stanolind conducted tests of the iodine tracer in 1952 in line flood of a sandstone reservoir of a Mid-Continent oil field. A semiquantitative analytical technique, based on the controlled electrolytic oxidation of iodide to free iodine, was employed to detect iodine in the produced water.

The tracer was introduced into the injection water from inception of the flood and was instrumental in determining progress of the flood front. Arrival of the injection water at producing wells varied from 6 to 9 months from the initial date of injection.

Stanolind chemists used a second well to determine the movement of iodine introduced into the injection waters as an iodine salt. Iodine salt was added at the wellhead of an input well in the concentration of 10 p.p.m. Four days after injection iodine appeared in sufficient quantity in the produced waters to definitely prove presence of channeling. Not all injection waters lend themselves to use of the iodine-tracer technique, the authors pointed out.

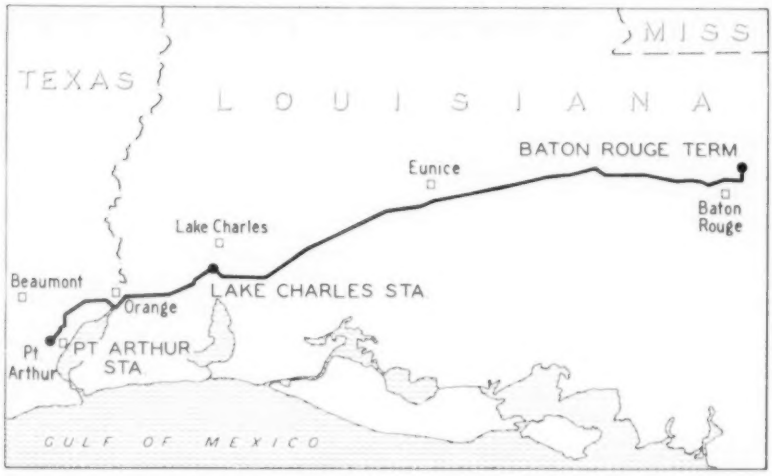
Bromide tracer . . . The chemists said that tracer possibilities of salts of bromine are currently being tested. However, since the naturally occurring bromine content of injection waters used in this case history is about 250 p.p.m., it was necessary to introduce relatively high concentrations of as much as 100 p.p.m. of these salts at the input well to enable detection of significant increases in bromine from produced waters.

Laboratory technique used to detect bromine is the quantitative spectrophotometric method. This involves oxidation of free bromine which gives a free and measurable color. Calibration of depth of color against quantity of bromine indicates the amount of bromine present in the water.

Copper tracer . . . A copper salt added to flood waters was used with limited success by the authors. The copper dithizone reaction method was used to detect the presence of copper in some produced water. Basically, the method is a sight test involving the change in color of a solution from green to yellow. However, presence of other metals in the waters, notably iron, will turn the solution pink. This interference limits applicability of the method.

Flow-meter innovation . . . A simple, inexpensive flow meter, built around a pair of ordinary screwed pipe tees, were described by Leo Garwin and Spencer H. Lander, engineers with Kerr-McGee Oil Industries, Inc., Oklahoma City. The device takes advantage of the ability of one tee to measure impact velocity of the flowing fluid while the other simultaneously measures static pressure.

A test meter was constructed and tested with pipe sizes ranging from ¼ to 1½ in. A study was made of flow water through the meter and the effect of modification of each component of the meter was analyzed systematically. Effect of flow turbulence also was investigated.



ROUTE OF LINE crossed 14 rivers, canals, bayous, and swamps and flooded rice fields.

Marshy Line Finished

Evangeline products system traverses 191 miles of rivers and water-logged land between Port Arthur and Baton Rouge

F. Lawrence Resen

PORT ARTHUR, Tex.—The Evangeline Pipe Line System, new products line from here to Baton Rouge, probably crosses as much water-logged, swampy country and as many rivers as any 191 miles of line in the world.

Plagued by water trouble from the moment construction was started, the new line is now in operation.

The 16-in. line is designed for an initial capacity of 96,000 bbl. daily with an ultimate throughput of 175,000 bbl. per day.

Owners of the new system are Texas Pipe Line Co., 40 per cent; Gulf Refining Co., 40 per cent; and Sinclair Pipe Line Co., 20 per cent. Texas Pipe Line constructed the system and will operate it.

Products are received at the Port Arthur terminal from The Texas Co. and Gulf Oil Corp. refineries here and the Sinclair refinery at Houston, and pumped to a booster station at Lake Charles where Cities Service Refining Corp. refinery adds to the line load. The line terminates at Plantation Pipe Line Co.'s Baton Rouge station.

Deliveries are made to Gulf's Opelousas, La., and to the Baton Rouge sales terminals of Gulf and Texaco, but the bulk of the products handled by the system will be transshipped eastward over Plantation's system.

Engineering-wise the system features a remote-controlled booster station. From a construction standpoint, it was marked by 14 water crossings including the Mississippi, crossing of water-soaked rice fields, and the further handicap of record-breaking rainfall and floods during construction.

The line runs slightly north of east from Port Arthur, passing south of Lake Charles and Opelousas and closely paralleling U. S. Highway 190. It crosses the Mississippi upstream from the highway bridge.

River crossings . . . In addition to this big river crossing, the line crosses the Sabine River, Intracoastal Canal, Vinton Canal, Chioupique Bayou, Calcasieu River, Nezpique Bayou, Teche Bayou, Cortableau Bayou, Wing Canal, Darboane Bayou, Atchafalaya River, Morganza Floodway, and Grosse Tete Bayou.

Three to 4-ft. ditches were dredged below the bottom of the Atchafalaya and the Mississippi and the crossing of all other streams were made with the pipe a minimum of 5 ft. below the river bed. Pipe at the river crossings and in about 4 miles of watery swamps was concrete-coated to provide it with a 10-lb. per ft. negative buoyance when empty.

The 2,700-ft. Atchafalaya crossing and the 4,700-ft. crossing of the Mississippi both required the use of a cutterhead dredge because of clay bottoms. It was necessary to extend the dredge ladder some 50 ft. to reach maximum depths of 85 ft. in both rivers.

The Atchafalaya crossing was pulled after individual sections were made up on the bank and pressure tested before being tied to the rest of the line. A laying barge was used on the Mississippi crossing after sections were first made up on the bank and tested.

The 16-in. o.d. line is made up of

CROSSING OF MISSISSIPPI was made just upstream of Highway 190 bridge near Baton Rouge. The 4,700-ft. line was laid 3 to 4 ft. below the river bed by Panama Williams Co.

56.36 lb. per ft., 0.312-in. wall pipe with the exception of the two main river crossings where heavy-wall (57.48 lb. per ft., 0.344-in.) pipe was used. The entire line was coated in temporary yards set up along the line route for convenience. They were located at Orange, Tex., and Welsh, Edgerly, Eunice, Port Berre, and Livonia, La.

With the exception of the water sections, the line is double-coated and double-wrapped. First the pipe was primed, then coated with enamel, then fiber-glass wrapped, enameled a second time, and wrapped again. The outer wrap is of glass felt with continuous, parallel glass-felt fibers imbedded in coal-tar saturate.

Rice fields . . . Crossing 120 rice fields presented the problem of preventing water from escaping the flooded fields during actual laying operations. This problem, together with generally marshy terrain and laying the line near the Intracoastal Canal, made pipe stringing difficult.

It was necessary to use barges for 17 miles and Athey wagons were pressed into service when trucks could not negotiate the right-of-way. Spring rainfall of between 30 and 35 in. caused local floods further hampering operations.

The line was laid by two spreads beginning north of Jennings, La., at state Highway 25. One worked east and the other west. Work started May 1, but the eastern spread shut down May 16 because of rainfall and floods. It was completed August 28, more than a month after the July 26 completion of the western section.

Contractor for the line was Panama-Williams Co., Houston. Subcontractors included J. O. (Red) Willett, Monroe, La., pipe stringing and hauling; J. Ray McDermott, New Orleans, dredging and marine equipment; Rosson-Richards Co., Houston, pipe coating. Stations were built by Station Construction Co., Houston.

SOUTHWEST

Texas Output Cut Again

Here's how 1953 figures compare with 1952—first Saturday each month vs. comparable date last year

	1953	1952	Change from 1952
January 10	3,229,000	2,942,000	+287,000
February 7	3,232,000	3,093,000	+139,000
March 7	3,065,000	3,138,000	— 73,000
April 4	2,872,000	3,091,000	—219,000
May 2	2,940,000	2,951,000	— 11,000
June 6	3,064,000	2,852,000	+212,000
July 4	3,135,000	2,725,000	+410,000
August 1	3,141,000	2,962,000	+179,000
September 5	2,981,000	3,250,000	—269,000
October 3	2,938,000	3,282,000	—344,000
November	**2,804,000**	**3,373,000**	**—569,000**
December	?	3,297,000	

AUSTIN. — November production in Texas will be at the lowest level since July of last year, when climbing crude inventories during the refinery strike forced a cut in output until refiners could work off some of the crude stocks.

The Texas Railroad Commission set the November allowable at 2,803,528 bbl. daily, representing the third successive cut since August.

The November allowable represents a net decrease of 337,293 bbl. daily since August 1. This decrease does not take into account the normal increases each month due to new production.

The November allowable is based on a 17-day statewide production schedule with 17 days also permitted for East Texas field in the 30-day month compared with 19 days for fields generally and 18 for East Texas in October, a 31-day month. Other fields not on the statewide schedule include Pantex with 16 days, Picton with 9, Spraberry Trend with 11, and Kelly-Snyder with 15.

A comparison of the estimated total allowable for November with the total for the same month last year shows a decrease of about 569,000 bbl. daily. November of last year represented an all-time high for the state, built up by four successive increases after the cut in July. The November total this year is the result of three sharp cuts. The decrease over last year is a net decrease and does not take into account normal gains from new wells. Between 1951 and 1952 this increase amounted to almost 400,000 bbl. daily. The all-time record allowable of 3,372,800 bbl. daily for November 1, 1952, was based on 23 producing days while the same number of producing days in November 1951 gave a total allowable of only 2,977,300 bbl. daily.

ALLOWABLES BY DISTRICTS
(Barrels per calendar day)

Dist.—	Nov. 1, 1953	Oct. 3, 1953	Nov. 1, 1952
1	42,940	44,168	43,410
2	142,305	152,460	184,858
3	446,077	466,859	536,555
4	252,000	266,938	293,100
5	47,586	50,006	56,650
6 (outside E. Tex.)	119,998	130,082	139,874
6 (E. Tex. field)	241,895	247,478	260,186
7-B	142,547	149,082	143,840
7-C	176,235	184,490	215,497
8	872,837	920,265	1,136,228
9	223,597	231,298	264,454
10	95,511	95,226	98,162
Total	2,803,528	2,938,352	3,372,814

PORT ARTHUR STATION of the new Evangeline system starts products from Texas Gulf area refineries on its way toward Baton Rouge. The new line's booster station near Lake Charles finishes the job of pumping to the line's terminal at Plantation Pipe Line's Baton Rouge station.

Importers Attacked

I.P.A.A. calls on President for help, asks companies to limit oil movements, and threatens to seek legislation

Henry D. Ralph

FORT WORTH.—The assistance of President Eisenhower in finding a solution to the problem of excessive imports of oil will be sought by the Independent Petroleum Association of America.

At its annual convention here October 19-20, the nation-wide producers' association unanimously adopted a three-part resolution which:

...Asks importing companies to limit imports of crude and products to 10 per cent of domestic demand.

...Calls on the President of the United States to "enlist the full cooperation of all elements of the industry and to take such action within his authority" as will reach a solution to the imports problem.

...Pledges the I.P.A.A. to work for legislation to limit imports unless other means prove effective before the next session of Congress convenes. *(In Washington last week the coal producers also threatened an all-out legislative fight against oil imports. See National Affairs.)*

The reasoning behind this resolution, as explained by several speakers supporting it, is briefly this:

Imports have increased for several months and threaten to continue to increase in the future in the face of an oversupply which has caused drastic reductions in domestic production.

The bulk of the imports comes from a handful of big companies with foreign production, but these companies may not be able to curtail imports either individually or through joint action because of antitrust laws and the pressure of foreign governments where they have concessions. Therefore the importers, assuming that they want to reduce imports, need assistance, such as White House support, in working out an effective program.

The Eisenhower administration, pledged to both development of international trade and prosperity of domestic industries, does not want a depression in the oil-producing industry and yet has opposed legislation restricting imports, so it should welcome this opportunity to evolve some limitation device short of legislation.

"Drowned in a flood" . . . The resolution was a compromise or composite of proposals for action discussed over a period of many months by the association's imports policy committee.

A few thought it was too much of a slap at those importing companies which are trying to curtail imports, while others thought the resolution was overly restrained and mild in view of the seriousness of the situation.

But there was no doubt that all domestic producers represented by the I.P.A.A. were of one voice in agreeing that they are about to be "drowned in a flood of foreign oil" and that some way must be found, and soon, to regain a larger share of the American market for American oil. Imports was the chief topic of most of the speakers on the program.

Chairman Ernest O. Thompson of the Texas Railroad Commission minced no words:

"Foreign crude is supplanting domestic crude. That is unfair. It must be promptly tapered off appreciably, or we shall seriously hamper our own domestic oil-producing industry and cripple our defense. We cannot safely or with prudence allow this to happen.

"The only crime the independent producers have committed is to have gone out and spent their money and found an abundant supply of domestic oil for peacetime pursuits and for the national defense.

"In return for this they are now flooded with a torrent of foreign oil that is supplanting our own oil. This is not fair to the domestic producer. It adversely affects our state revenues. It robs Texas of her oil market.

"We have three times in three successive months cut Texas' allowables, a total of 345,000 bbl. per day. At $2.85 a barrel this amounts to $983,000 lost in income to Texas producers.

"The independent producers cannot stand further reductions in runs without serious danger of bankruptcy. Surely the voice and strength of 13,000 independent oil producers, and the landowners and royalty owners joined by the strength of our 26 sovereign oil-producing states, can be heard above that of a dozen importers."

Most serious problem . . . In his annual report as president of the association, Charlton H. Lyons, Shreveport, said:

"The most serious problem that confronts the domestic industry is imports.

"We do not condemn all imports as injurious, or do we attribute all injuries to imports.

"There is no doubt that imports have been the principal cause of present excessive oil inventories. Nor is there any doubt that if production continues to be curtailed that the domestic industry will be undermined and weakened to such an extent that it will be unable to supply the petroleum needed by our expanding economy and defense programs.

"Consequently, it is in the national interest that a balanced relationship be maintained between imports and domestic demand."

Lyons reviewed the world petroleum situation to show that supplies and pressure to import are increasing, and suggested that we should import only from areas which could be most easily defended in case of war.

An attack on two officials of Socony-Vacuum Oil Co. group, B. Brewster Jennings, president of the parent company, and Robert L. Minckler, president of the subsidiary, General Petroleum Corp., featured the annual report of Russell B. Brown, general counsel of the I.P.A.A.

These two, Brown said, used Oil Progress Week as a forum to paint a dismal picture of the future ability of the United States to supply its own oil and asserted that the nation must depend on imports to an increasingly greater extent.

The plight of the domestic industry, Brown said, is largely the making of Socony-Vacuum and a few other big importers. He said it is not true that we are running out of oil, but if the public becomes convinced that we are, the domestic industry will get little support in its present and future problems.

Natural Gasoline Reduced

Excessive inventories of finished motor fuel and warmer-than-normal weather combined to force a reduction in posted prices of natural gasoline last week at a time when the market should be gaining strength.

First reductions were reported in North Texas for October 14. Surplus natural gasoline from this area normally moves to the Gulf Coast and the motor gasoline market on the Gulf Coast has been weakening for several weeks.

Prices for Grade 26-70 before the cut were 6.375 cents a gallon in Group 3 and 5.875 cents in North Texas. By October 21 prices were down to 5.5 cents for Group 3 and 5.0 cents for North Texas.

RISING COSTS of exploration drew the attention of Ernest O. Thompson, right, chairman of the Texas Railroad Commission, in an address to the association. Shown at the speakers' table from left to right are C. H. Lyons, Shreveport, and Fred W. Shield, San Antonio, both former I.P.A.A. presidents, and Charles N. Wallace, Billings, Mont., who presided at the general session.

Oil Prices Still Lag

Independents told rising costs still are outstripping prices; Thompson sets daily per-well income at $34.55

FORT WORTH. — Rising costs of producing oil and the difficulties of obtaining compensating prices for petroleum were the chief topics of discussion at the annual meeting of the Independent Petroleum Association of America in addition to imports and the supply-demand forecast (see separate news reports in this section).

The price of crude oil should be raised to compensate for increasing costs of production, the association was told in a report from its cost study committee.

Oil producers' costs in 1952 were up more than 50 per cent over 1947 costs, and during the 5-year period crude prices in general remained unchanged, due principally to governmental restrictions, said the committee, and this created a squeeze on oil and gas producers who were forced to absorb more than 75 cents per barrel in additional finding, developing, and producing costs while prices remained frozen.

The increase of 25 cents per barrel in June 1953, accounted for only about one-third of the increased expenditures per barrel and raised the average price less than 10 per cent above the 1947 level, the report pointed out. Since then, it said, all costs have continued to rise, and have increased approximately 15 cents per barrel during the first 7 months of 1953.

Income per well . . . Chairman Ernest O. Thompson of the Texas Railroad Commission also dwelt on these rising costs in his address to the meeting, saying:

"Last year, 1952, saw your exploratory wells cost an average of $100,000 each. Yet eight out of nine were dry holes. That makes every discovery cost on the average $900,000.

"The average independent producer in this country produces 14 bbl. per well per day. The average price is $2.85 per barrel, or thereabouts. Fourteen times $2.85 equals $39.50 gross income average per well per day. Subtract one-eighth royalty of $4.95 from $39.50—that leaves you the grand total of $34.55 per well to pay your operating costs, your taxes, your interest, and all the many other items you must as a businessman bear if you are to stay in business. It's pretty hard to see how you can possibly come out in cold competition to Middle East oil where the wells produce up to 10,000 bbl. of oil per well per day."

Still a bargain . . . An adequate price for petroleum products serves to protect the consumer, protect competition, and avoid political management of the petroleum industry, it was declared by L. S. Wescoat, president of Pure Oil Co., in addressing the meeting.

The purchaser of the power contained in gasoline has one of the best bargains he ever has had in the American domestic market, he said, and the consumer now buys as much power for 45 cents as he received for 63 cents 27 years ago.

Wescoat said that continued availability of both oil and natural gas depends on a fair price, and it is manifest that if prices are held artificially below a free market survival point for any length of time, many small producers, refiners, and jobbers will be compelled to sell out or get out.

Officers named . . . The next annual meeting of the I.P.A.A. will be held in Tulsa in the fall of 1954. W. M. Vaughey, independent producer of Jackson, Miss., was elected president, succeeding Charlton H. Lyons of Shreveport. C. L. McMahon, Jr., of C. L. McMahon, Inc., Tulsa, was elected treasurer, succeeding D. R. Snow, Tulsa. Newly elected vice presidents are:

Paul C. McDonald, El Dorado, for Arkansas; C. Richard Collins, Mount Vernon, Illinois; John R. Lavens, Jr., Evansville, Indiana; A. J. Boundy, Wichita, Kansas; V. O. Sims, Owensboro, Kentucky; A. R. Wherritt, Shreveport, North Louisiana; Alex J. Brunini, Vicksburg, Mississippi; A. R. Jones, Kansas City, Missouri; Winston L. Cox, Billings, Montana; Harvey E. Yates, Artesia, New Mexico; Knight Thornton, Wellsville, Western New York; W. E. Shrider, Hebron, Ohio; Watson W. Wise, Tyler, Northeast Texas; J. Harold Dunn, Amarillo, Texas Panhandle; J. R. Butler, Houston, Southeast Texas.

ADEQUATE OIL PRICES as protection for competition and the consumer alike were termed a guard against political management of the petroleum industry by L. S. Wescoat, Chicago, president of Pure Oil Co.

Forecast for 1954 . . .

. . . I.P.A.A. sees increase of 2.5 per cent in total demand next year, less than half that anticipated for this year

FORT WORTH.—Total demand for petroleum products is expected to increase 2.5 per cent in 1954 compared with an estimated 5.3 per cent for this year, according to the latest forecast of the supply and demand committee of the Independent Petroleum Association of America.

Total demand for next year is forecast at 8,332,000 bbl. daily. The committee told the annual I.P.A.A. meeting here last week that these forecasts are based on the assumption "that the level of general business activity during the coming year will be somewhat lower than in 1953 but not to the extent that would have any significant effect upon total petroleum demand."

Domestic demand is expected to increase 3.6 per cent for 1954, but part of this gain will be offset by a decrease in exports amounting to 18.4 per cent.

Distillate demand in this country next year is forecast at 1,492,000 bbl. daily for a gain of 7 per cent over 1953. The estimate for gasoline demand of 3,525,000 bbl. daily represents a gain of 4.5 per cent. Kerosine is expected to increase 2.9 per cent, but residual fuel sales will be slightly less than this year.

Total stocks of crude and products will increase about 19,000 bbl. daily in 1954 compared with a gain of 52,000 bbl. daily this year, according to the report. Since additions to storage will be less, required new supply for next year will be only 2.1 per cent greater than this year compared with the gain of 2.5 per cent in total demand.

Crude outlook . . . The committee did not include estimates of crude production in its formal forecast but did report that the amount of production needed to maintain adequate inventories will be about 6,600,000 bbl. daily if production of natural gas liquids averages about 681,000 bbl. daily and if imports remain at the 1953 level, estimated by the committee at 1,070,000 bbl. daily.

This rate compares with an average of 6,520,000 bbl. daily for the first 9 months of this year and a probable required production of 6,275,000 bbl. in the fourth quarter. The last quarter production assumes an output of 682,000 bbl. daily from natural-gasoline and cycling plants and total imports of 1,125,000 bbl. daily.

Final revised estimates for 1953 are shown in the small table along with fourth quarter averages. Total demand in the fourth quarter is expected to be about 8,625,000 bbl. daily for an all-time record.

Total stocks climbed to 743,000,000 bbl. at the end of the third quarter but are expected to go to only 732,000,000 bbl. by the same date next year.

Refinery runs for next year are forecast at 7,169,000 bbl. daily compared with 6,993,000 bbl. daily this year.

SUPPLY AND DEMAND FORECAST FOR 1954

(Thousands of barrels daily)

	First quarter	Second quarter	Third quarter	Fourth quarter	Year 1950	Per cent inc. over 1953
Total demand:						
Gasoline	3,265	3,775	3,830	3,560	3,607	+ 3.9
Kerosine	520	235	225	495	369	+ 1.4
Distillate	2,170	1,180	1,035	1,890	1,568	+ 5.4
Residual	1,845	1,515	1,425	1,735	1,631	— 1.2
Other	1,055	1,165	1,280	1,125	1,157	+ 0.3
Total	8,855	7,870	7,795	8,805	8,332	+ 2.5
Exports:						
Gasoline	85	85	80	80	82	—14.6
Kerosine	15	15	15	15	15	—25.0
Distillate	80	80	75	70	76	—19.1
Residual	60	55	50	45	53	—18.5
Other products	55	55	55	50	54	—10.0
Crude	50	45	40	40	44	—29.0
Total	345	335	315	300	324	—18.4
Domestic demand:						
Gasoline	3,180	3,690	3,750	3,480	3,525	+ 4.5
Kerosine	505	220	210	480	354	+ 2.9
Distillate	2,090	1,100	960	1,820	1,492	+ 7.0
Residual	1,785	1,460	1,375	1,690	1,578	— 0.5
Other	950	1,065	1,185	1,035	1,059	+ 2.7
Total	8,510	7,535	7,480	8,505	8,008	+ 3.6
Total stock change	—456	+396	+478	—348	+19	
Required new supply	8,399	8,266	8,273	8,457	8,351	+ 2.1
Closing stocks (millions of barrels):						
Gasoline	167	151	138	147	147	.....
Kerosine	16	27	37	28	28	.....
Distillate	54	84	125	102	102	.....
Residual	38	44	53	47	47	.....
Other products	102	107	104	101	101	.....
Crude	275	275	275	275	275	.....
Total	652	688	732	700	700	.....
Runs to stills	7,115	7,148	7,209	7,204	7,169	+ 2.5

REVISED DEMAND ESTIMATES FOR 1953

(Thousands of barrels daily)

	Fourth quarter	Year 1953	Per cent inc. over 1952
Total demand:			
Gasoline	3,415	3,470	+6.6
Kerosine	500	364	+0.6
Distillate	1,825	1,488	+6.0
Residual	1,770	1,651	+3.5
Other	1,115	1,153	+4.6
Total	8,625	8,126	+5.3
Exports	340	397	—8.9
Domestic demand	8,285	7,729	+6.2
Stock change	—543	+52	
Required supply	8,080	8,178	+4.5
Closing stocks:			
Gasoline	146	146	.....
Kerosine	26	26	.....
Distillate	103	103	.....
Residual	44	44	.....
Other products	99	99	.....
Crude	275	275	.....
Total	693	693	———
Runs to stills	6,929	6,993	+4.8

Oil Produced From Shale

NEW YORK.—Crude-shale oil has been produced directly from Colorado shale beds for the first time through the use of controlled underground-combustion techniques, Sinclair Research Laboratories, Inc., announced here recently.

The new method, designed to allevi-

ate mining, crushing, and other costs involved in extracting oil from shale the conventional way, is under going field tests on Haystack Mountain near De Beque, Colo. However, the quantities of oil produced on the mountain have been small and more experiments are scheduled to determine the commercial feasibility of the new techniques.

For over 5 years Sinclair has been conducting extensive underground-combustion experiments in an Oklahoma oil field.

WORK NEARS COMPLETION on these stripping columns in the acrylonitrile section at American Cyanamid Co.'s nitrogen plant under construction at Avondale, La., near New Orleans.

New Petrochem Trends

High-pressure partial oxidation using oxygen looms as one of most important developments in ammonia manufacture

John C. Reidel

NEW trends are developing in the field of nitrogen petrochemicals.

New plants, new process designs, and other developments are focusing attention on ammonia, urea, hydrogen cyanide, acrylonitrile, and other nitrogen-containing petrochemicals.

One of the principal trends which appears to be emerging is the manufacture of synthesis gas by high-pressure partial oxidation, using oxygen. This is important because hydrogen production is of prime concern in the manufacture of ammonia.

Another approach which is being considered is the manufacture of synthesis gas through high-pressure partial oxidation with air, but this process is not yet commercially available. By-product refinery or petrochemical streams rich in hydrogen provide another source for the hydrogen required in ammonia synthesis.

Ammonia is a key material in these new developments because it is both a principal product and also a raw material for the manufacture of other petrochemicals.

Some of the ammonia to be made in plants now being built will go into the manufacture of urea. Ammonia also helps to start off an important petrochemical chain since it is a feed material for production of hydrogen cyanide. This, in turn, enters into the manufacture of acrylonitrile and other petrochemicals. Acrylonitrile is a versatile reactant which has many existing and potential uses. Much attention has been shown in the trend toward its manufacture from acetylene and HCN.

Ammonia's growth . . . Ammonia is the No. 1 petrochemical in tonnage, recording a 1952 production, based on natural gas, of more than 1,000,000 short tons. Of the total anhydrous ammonia output, 50 per cent or more, according to various estimates, is petroleum derived. If current plant conversions from coke to natural gas are included, the figure may approach or even exceed 60 per cent.

Twenty years ago the annual ammonia production was little more than 300,000 tons. Of this, only about 3 per cent was derived from natural gas. In 1940 total production was approaching 500,000 tons, of which less than 10 per cent was based on petroleum raw materials, according to figures cited recently by R. P. Louthan, A. M. Schnitzer, and J. E. Mahan, of Phillips Petroleum Co. at the American Chemical Society symposium on petrochemicals in Chicago. Today natural gas is definitely the dominant raw material for ammonia manufacture.

The marked conversion from coke to natural gas for ammonia manufacture was emphasized by F. D. Kuenzly, of Shell Chemical Corp., at the California Natural Gasoline Association *(See page 112).*

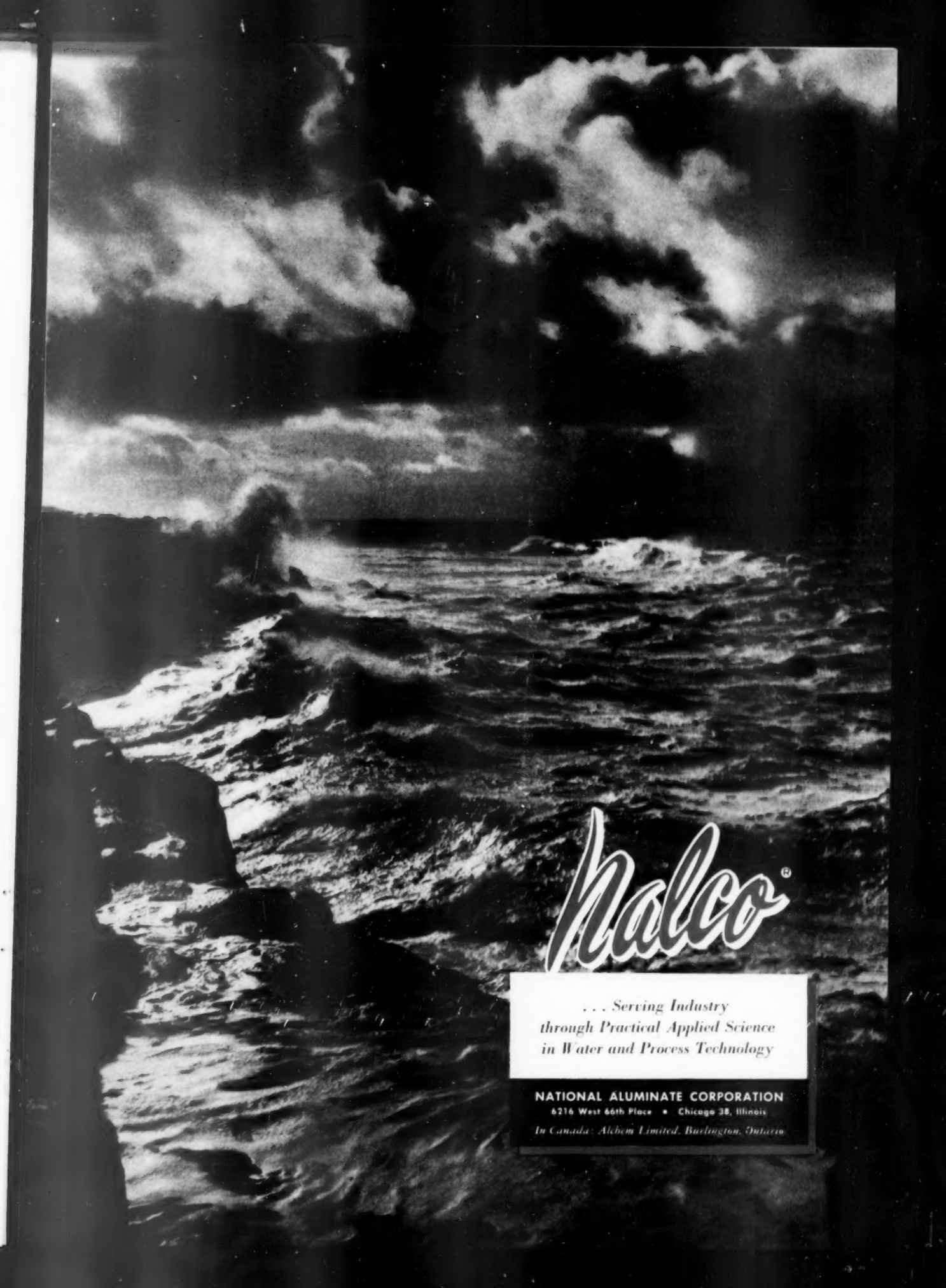
By 1955 total anhydrous ammonia production is expected to be close to 3,500,000 tons, with natural gas furnishing more than 75 per cent of this amount.

Why partial oxidation? . . . Listed among new ammonia plants now under construction *(Table 2 of the Petrochemical Plant Survey, Page 92)* are Deere & Co. at Pryor, Okla.; Spencer Chemical Co. at Vicksburg, Miss.; and Grace Chemical Co. at Woodstock, Tenn., near Memphis. All of these will employ the partial oxidation with oxygen for making synthesis gas.

The noncatalytic, high-pressure partial oxidation with oxygen is conducted at about 400 psi. rather than at atmospheric pressure as in existing ammonia plants which react natural gas (methane) with steam over a nickel oxide-type catalyst. Ammonia synthesis, however, is conducted by the Casale or other process at much higher pressures, ranging from 200 atmospheres or lower to as high as 1,000 atmospheres. A significant saving in compressor load may be achieved by making the synthesis gas at the higher pressure.

Hydrogen-rich streams . . . Other plants under construction or to be constructed will use available hydrogen-rich streams. Thus Atlantic Refining Co. at Philadelphia will employ the recycle hydrogen gas stream from its catalytic reforming unit.

National Distiller's Products Corp. recently announced that it will employ hydrogen obtained as a byproduct from the National Petro-Chemical Corp.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ethylene cracking unit now under construction at Tuscola, Ill.

Air partial oxidation . . . Some cost figures for this potential process were presented recently by B. J. Mayland, E. A. Comley, and J. C. Reynolds, of Girdler Co., before the San Francico meeting of the American Institute of Chemical Engineers.

Cost comparisons showed that air partial oxidation at elevated pressure was advantageous over conventional steam reforming by way of substantial savings in operating cost and a reduction of about 12 per cent in investment cost.

However, they noted that other factors must be considered. Potential advantages are adaptibility of this method to the use of liquid hydrocarbon feed stock. Disadvantages, they said, "are the unforeseen difficulties which might be encountered in engineering and constructing the plant for carrying out this process."

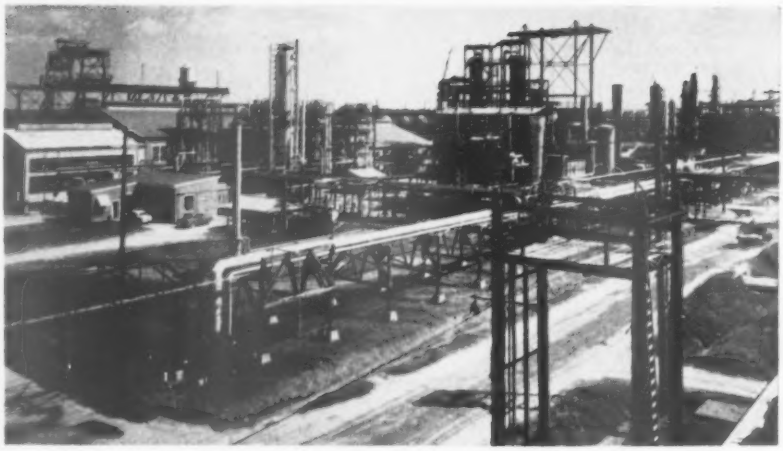
Other nitrogen petrochemicals . . . Urea has a high nitrogen content and is easily handled, hence particularly suitable for marketing as fertilizer. It also goes into resin and plastics manufacture and animal feed supplement. Urea can be made by reacting the byproduct CO_2 formed in the synthesis gas shift reaction with a portion of the ammonia.

Manufacture of hydrogen cyanide from natural gas and ammonia was first started in 1949. The Materials Policy Commission Report *(The Oil and Gas Journal, September 8, 1952, page 114)* estimated that for 1952 close to 70 per cent or about 130,000,000 lb. out of a total of slightly over 190,000,000 lb. production of HCN would be of petrochemical origin.

Production of acrylonitrile, used in special nitrile rubbers, and with possible expanded uses in acrylic fibers, soil conditioners, and plastics, was some 40,000,000 lb. in 1952 and this was expected to quadruple by 1956. Most of the 1952 production was believed to have been by the reaction of petroleum-derived ethylene oxide and HCN. This process is reported used by Carbide & Carbon Chemical Co. It is also reported that Monsanto Chemical Co. is making acrylonitrile by reaction of acetylene derived from natural gas and HCN.

American Cyanamid Co. is constructing facilities for making acrylonitrile via acetylene at the new Fortier plant located at Avondale, La., near New Orleans.

Still other nitrogen-containing petrochemicals include adiponitrile, a nylon intermediate, amides, aminee and pyridines, and agricultural chemicals.



RECENT EXPANSION has doubled capacity of Commercial Solvents Corp.'s Sterlington, La., plant to 30,000,000 gal. of methanol and 140,000 tons of synthetic anhydrous ammonia per year.

Ammonia Plant Finished

New facilities at Commercial Solvent's Louisiana plant will also produce 30,000,000 gal. of synthetic methanol

STERLINGTON, La. — Commercial Solvent Corp. facilities for production of ammonia and synthetic methanol from natural gas doubled last week with the opening of new plant installations in the Monroe field of North Louisiana.

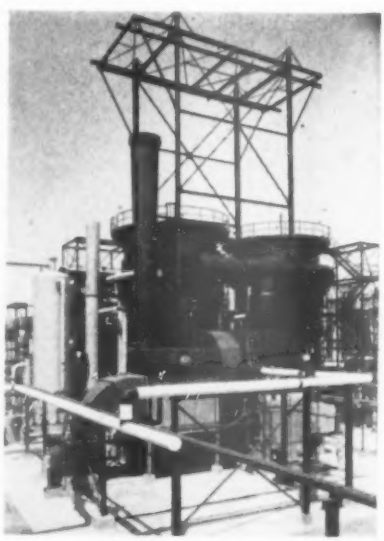
The expanded CSC facilities will increase annual production of ammonia by 70,000 tons and will boost methanol production to 30,000,000 gal. a year. The $20 million expansion program doubles national production of both basic petrochemicals and is the first of the chemical industry's privately financed nitrogen expansion projects to be completed and in production since World War II.

The new facilities were formally dedicated here last week by J. Albert Woods, Commercial Solvent president.

Gas consumption for the expanded operation has risen to 50 million cu. ft. daily. Originally, the Monroe field provided the gas for operations, but needs have so increased that natural gas is now delivered to the plant from several fields in Louisiana and Texas.

Ammonia produced in the new unit will be processed into approximately 75,000 tons of ammonium nitrate fertilizer and 30,000 tons of nitrogen solutions. The ammonium nitrate operation is carried out in a new unit located near the basic plant.

This plant employs the unique Stengel process in its first commercial application. The new method, named for Dr. Leonard A. Stengel of CSC's Research Division, eliminates the conventional prilling towers, coolers and driers. This permits lower capital investment, reduced operating expenses and shorter construction time. With the Stengel process, particle size can be changed and "custom sized" to meet customers needs. A pilot plant which has been in operation at Sterlington for the past 2 years, formed the basis for designing the new commercial unit.



NATURAL GAS is reformed in these units for conversion to methanol. In the foreground are the air preheater and waste-heat boiler.

Imports Facing Fight

Coal producers serve notice of coming legislative battle for restrictions on the importation of residual fuel oil

WASHINGTON.—The nation's coal producers served notice last week that they will renew and intensify their drive for restrictions on the importation of residual fuel oil when Congress meets next year.

Industry leaders speaking before the annual convention of the National Coal Association called for Defense and State Department aid in combating unrestricted imports of oil.

The Government, the association was told by Dr. R. E. Snoberger, chairman of its natural resources committee, should be awakened to the fact that "we cannot fight a war on oil and gas and win—we never have and we never shall."

Interior Secretary Douglas McKay expressed concern over the coal industry's situation and the necessity of keeping the industry strong, but told the association his responsibility extends to oil and natural gas as well as coal. He said, "I cannot and certainly will never be required to favor one above the other."

L. C. Campbell, association president, promised a strong fight for the oil-quota legislation sponsored this year by Rep. Richard M. Simpson of Pennsylvania. It secured an "almost phenomenal" 161 supporting votes in its first test in the House.

Campbell warned that imports are not only of concern to coal producers on the eastern seaboard but "this unrestricted importation of foreign oil has implications that affect not only the entire coal industry but our entire economy."

Study asked . . . An impartial study of the whole fuel problem by the federal Government was urged by Tom Pickett, executive vice president. Pickett called for restrictions on the use of natural gas for inferior purposes "in order to maximize special advantage usage where gas serves its high economic function."

The coal producers were told they have a vital interest in all matters pertaining to oil and natural gas, and a stake in both the pending "cartel" suit in New York and the Phillips Petroleum Co. case before the Supreme Court.

The cartel suit places on front-line importers of residual fuel oil "an obligation to account to the court for their international trade practices."

"The ultimate outcome of this suit could have a significant effect upon the coal industry and will be watched with great interest in view of the fact that coal has suffered such extensive damage as a result of unrestricted oil importation," R. E. Hall, counsel of the association, said.

Equally important, Hall continued, is the Phillips case involving the question of the Federal Power Commission's authority to regulate producers of natural gas.

"As it stands now," Hall explained, "with the Federal Power Commission forced by the court's decision to keep the price of gas down to the cost of production (in many instances far below the fair commodity value) natural gas in many cases undersells coal to the point where huge quantities of this limited natural resource are being wasted for inferior uses under boilers which could just as well be served by our abundant supplies of readily available coal."

Safety threat . . . Hall also discussed the alleged threat to the safety of working coal mines presented in natural-gas storage in the vicinity of the mines, and reported that Pennsylvania coal operators have taken "positive steps" looking toward the enactment of adequate state legislation covering such storage.

The association counsel asserted that "recent unfortunate experiences in the State of Illinois suggests that the whole problem of gas storage needs attention." He said West Virginia operators also are reviewing the present state statutes to determine their adequacy "to meet the challenge of this new situation."

Big Inch Gas Line Proposed

WASHINGTON. — Construction of a large-diameter Gulf-East Coast gas pipe line which could be converted to the movement of oil products in the event of war is under discussion.

Officials of the Petroleum Administration for Defense are sounding out gas industry executives on the idea as a substitute for the super-inch products line proposal which was given a chilly reception by oil men at last month's meeting of the National Petroleum Council.

Only the barest outline of the proposed defense pipe line has been developed so far. It calls for construction of a 36-in. line which would carry gas in peacetime on an interruptible basis, possibly even with some uninterruptible service, and which could readily be converted in the event of an emergency to provide alternate transportation for products now moving to the East Coast by tanker.

If the idea of a gas line catches on it will be necessary to work out details of the government's participation in the project. While a line might be built by the industry itself, it might be considered necessary to provide oil-pumping facilities which could be tied in quickly. It would be up to the government to provide them.

U.S. Decision Due

Showdown near on alkylate facilities, big pipe line

WASHINGTON.—The oil industry appeared this week to be ready for a showdown with the government on the question of oil-facilities expansion.

Within the next few weeks the National Security Council is due to make important decisions on two projects which it has been represented as strongly supporting—expansion of alkylate facilities and construction of a Gulf-East Coast defense pipe line.

Both projects have been put up to the industry, which has shown no inclination to undertake either. In effect, the industry has said if the government wants more alkylate plants and the pipe line it can build them. There appears at the moment to be no need for either, nor any assured market to support them.

Some time ago the NSC came out for a 20,000 bbl. expansion in daily alkylate production, with the threat that if it wasn't supplied by the industry the government would build units. The Petroleum Administration for Defense took on a new survey of potential alkylate supply and has found considerably more available than had been anticipated. Definite figures from the survey should come along soon,

showing just where the country stands on avgas components.

Super-inch cools . . . The government did not put much heat under the super-inch pipe line proposal but put out a couple of feelers to get industry reaction. It was highly unfavorable. Since the project would involve a considerable outlay even by oil industry standards, there has been less talk of government construction than in the case of alkylate facilities. The latter could be financed by the more than $60,000,000 the Defense Department has from its fund for encouraging the building of alkylate units by refiners.

The Office of Defense Mobilization also has been talking about new expansion goals for refining. Here, again, the industry is exhibiting little interest, in view of the current over-supply and the charges of independent refiners that the effect of the expansion already accomplished has been to run them through the wringer. Washington officials are not optimistic over the chances for new programs until the supply and demand situation is straightened out.

CANADA

New Line Brings Price Cut

VANCOUVER, B. C.—Product prices have dropped in British Columbia as a result of the completion of the Trans Mountain pipe line.

Imperial Oil, Ltd., announced the first reduction, a cut of 1.1 cents per gallon for both gasoline and heating oils.

The Trans Mountain line delivered its first crude to the Burnaby manifold October 17, two days after the line's formal dedication and only 4 days after the last weld was made at Bradner, 27 miles east of the Burnaby terminal.

With the first crude delivery, Imperial's Ioco refinery became the first in this province to operate entirely on Canadian crude. The new Shellburn refinery of Shell Oil Co. of Canada, Ltd., is being placed on production in progressive stages with completion scheduled for next February.

Oil Search Is Expensive

EDMONTON, Alta.—The oil industry is spending $1,000,000 a day in exploring for oil and gas in western Canada, R. H. C. Harrison, president of the Canadian Petroleum Association, estimated here last week.

Harrison said this figure represents a 20 per cent increase over exploration expenditures in 1952.

WATCHING WASHINGTON

Bertram F. Linz

Price Boost Still Echoes

The echoes of last spring's oil price increases haven't died away yet.

A grand jury investigation of the way major oil companies handle the pricing problem may be called to test the theory that the "market leader" sets prices and the rest of the industry lines up behind it.

The Federal Trade Commission had the idea a couple of years ago that follow-the-leader pricing should be in violation of the antitrust laws —in effect that it should be illegal for any two sellers of the same commodity to quote the same price.

The Justice Department will attack the industry's pricing, if it goes into the matter, from a different angle. It will attempt to develop that price levels are fixed by some sort of arrangement between the companies. The department may contend that it is not necessary to hold meetings to reach an arrangement—may argue that the acceptance by other companies of the leader's new prices accomplishes the same purpose.

Within a matter of weeks, also, the House commerce committee, which held a series of hearings on the price changes last spring, may resume its investigation with an eye to determine how the industry justifies the increases at a time when operations are being cut back all along the line because of oversupply.

"Must" Issues Mounting

The 1954 session of Congress is going to face a whale of a program, even if it does no more than deal with the "must" problems already piled up.

A mere half-dozen issues are of sufficient magnitude to keep the legislators busy right from the start, particularly if Congress is to adjourn early in the summer to give time for the rip-snorting election campaigns that appear to be in the works.

These issues include tax revision, a broadened social security program, a new foreign trade program, Taft-Hartley Act revision, foreign aid and federal-state relations.

On the tax front, Congress is faced with the necessity of making up by mid-1955 some $8 billion lost revenue because of termination of the increases and special levies adopted in the face of the Korean emergency.

Revision of the Taft-Hartley Act and the proposed new foreign trade policy have all the elements needed for long-drawn-out controversies. So does the proposal to revise federal-state relations, which involves a division of the tax field between Washington and the states and a sharp cut-back in federal aid programs.

Foreign aid will come up in connection with appropriations and a new economy drive which, like all recent economy drives, will run head-on against increased international tensions which will prevent substantial cuts in military expenditures.

Incidentally, the cut of approximately 10 per cent in individual income taxes next January 1 will not be all velvet for wage and salary workers. On the same date the social security tax will increase from 1½ to 2 per cent on the first $3,600 of income which means that people making $300 or more a month will have to chip in an additional $18 a year.

As a result of this combination of reduced-income and increased-security taxes a man making $225 a month will pay $1.02 more each month in taxes, while the worker making $300 a month will benefit by a big 10 cents.

Research Funds Sought

A committee of scientists recommended this month that the National Bureau of Standards be given money and encouragement to bring its basic research up to date.

The plight of the bureau was not attributed to its officials. Rather, it was the result of the tremendous demands made up it by the Defense Department and the Atomic Energy Commission, which are now being cut back.

The committee commended the work of the heat and power division, which deals with engines and lubrication, and engine fuels, but commented it is placing undue emphasis on developmental work for other agencies due to the inadequacy of direct appropriations in contrast with the money available from other sources for this work.

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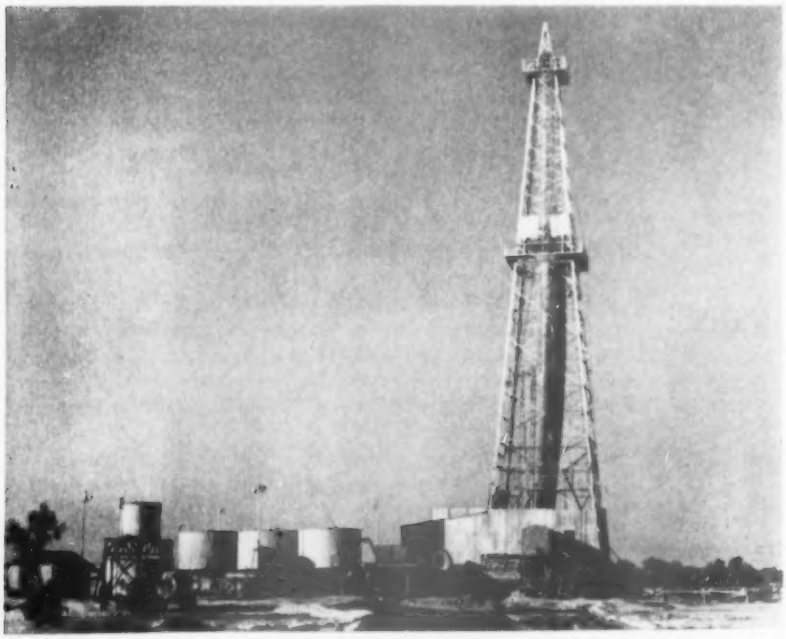
GROUND WATER close to the surface hampered the work of ditching machines laying the new Zubair line. This machine working near Abu Flus, northwest of Seeba Camp, moves ahead of a ditch already partially filled with water. A section of the 24-in. pipe is at the right of the ditch and in the distance is the existing 12-in. line.

Persian Line Completed

New 24-in. crude line from Zubair field to Gulf terminal in southern Iraq is part of increased production program

A NEW 24-in. pipe line has been completed from Zubair field to a Persian Gulf tanker loading terminal at Fao in southern Iraq.

Construction of the 65-mile line is a part of the program of the Iraq Petroleum Co., Ltd., group to increase production from this area to 8,000,000 tons, or about 160,000 bbl. daily, by the end of 1955.



A BASRAH PETROLEUM RIG testing deeper formations in Zubair field, the deepest producing field in the Middle East. The present production program for the field calls for another 20 of these 11,000-ft. wells by the end of 1956.

Work is moving ahead on other phases of this program. A third tanker jetty is under construction at Fao, and additional oil-handling and pumping equipment is being installed in the field. A steady program of development drilling is being carried out, along with further exploration, including the Rumailia wildcat now undergoing tests southwest of the field near the Kuwait border.

Zubair field was discovered in 1949. The operating company, Basrah Petroleum Co., Ltd., which is associated with I.P.C., laid a 72-mile, 12 and 16-in. line in 1951 to Fao on the Shatt-el-Arab River where a tanker terminal was built. First exports of crude began in December 1951.

The new and larger 24-in. line is buried in contrast to the earlier 12 and 16-in. which was laid aboveground on concrete sleepers. The pipe, comprising 15,630 joints weighing 17,164 tons was manufactured in England by South Durham Steel & Iron Co. This marks one of the first occasions where large-diameter line pipe has been obtained in Europe.

The 24-in. follows a somewhat different route than the earlier line and is 7 miles shorter. It extends eastward from the field 16 miles to the village of Hamden and then south for 6 miles to the bank of the river. From this point it cuts across 13 miles of desert to Seeba, location of the main construction camp, and finally follows the main road for the remaining 30 miles to Fao.

Transportation of equipment and pipe from the port at Basra to Seeba and to locations along the route was a problem. Because of weight limitations on the bridges, heavy equipment and much of the pipe was barged downriver from Basra and unloaded by use of floating cranes.

Even more trouble came from underground water. Near the river, on the last section at the Fao end, water was a foot under the surface. Prongs were fitted on the back of the ditcher buckets so that water could drain through, and steel blades were attached to the sides of the machine to flatten the top of the ditch and prevent caving.

Work moved ahead on the line during the summer, despite intense heat and temperatures of up to 120° in the shade. Summer dust storms slowed down welding and made it difficult to dope and wrap the pipe. Laying of the section west of Hamden was delayed several months because of river floods in the area.

Production to increase . . . Production from Zubair field during the first half of this year averaged about 60,800 bbl. daily. As other necessary facilities are completed and additional wells drilled over the next 2 years, production will be gradually stepped up to meet the 8,000,000-ton minimum rate required under the concession agreement by January 1, 1956. When the company began commercial exports from Zubair in December 1951, it was some 9 months ahead of the concession obligation in this respect.

At present, the field has 27 productive wells. The 8,000,000-ton rate by the beginning of 1956 calls for 45 producers doing 5,000 bbl. daily each.

Deep field . . . Zubair is the deepest producing field in the Middle East, and consequently development is slower and more expensive. Early this year, Basrah Petroleum set a Zubair drilling-time record of 100 days, but average well time is longer. The wells are completed at about 11,000 ft. in a Lower Cretaceous sand which is the third of four pay zones. Gravity of the crude is 35°.

The field has been proved for a length of 22 miles, but the ends are as yet undefined. The Shuaiba Dome now being produced and developed has been defined over 12½ miles with a 2½-mile maximum width. The fourth pay, at about 11,300 ft., produced 43° gravity oil in Zubair No. 24. This crude is the lightest thus far found in the Middle East.

13,000 Leave Jobs

Aramco operations go on despite walkout of workers

APPROXIMATELY 13,000 of the 15,000 Saudi Arabians employed by Arabian American Oil Co. in its field operations were out on a general strike last week in what appeared to be mainly a protest against the government's labor policies.

Producing and refining activities of the company were continued without interruption by the remaining force, including some 4,000 Americans, and by the middle of last week, the strikers were reported to be gradually returning to their jobs.

It was the first major labor disorder to affect Aramco in nearly 20 years in Saudi Arabia. The company's total personnel in its extensive operations in Eastern Saudi Arabia amounts to approximately 25,000, consisting of 6,000 nationals of other countries as well as the 15,000 Saudis and 4,000 Americans.

A committee was recently appointed by Crown Prince Saud to investigate labor complaints from Aramco employes. The strike movement began when a number of Saudis—one report gave the total as 100—were arrested for failure to cooperate with the committee. Labor unionization is prohibited under Saudi Arabian law, and the general discontent apparently gave impetus to the walkout.

Saudi Arabian troops were moved into the key company centers of Dhahran, Abqaiq, Ras Tanura, and Uthmaniyha the day before the strike began on October 17. There were several reports of riots and disorders, but since no foreign newspapermen are allowed in Saudi Arabia, these reports emanated from Bahrein and Beirut and were unconfirmed.

The only phase of the company's operations affected was drilling and the three or four rigs operating were shut down. The strike did not extend to the Trans-Arabian Pipe Line which carries about 300,000 bbl. daily of Aramco crude to the Eastern Mediterranean. Total Aramco production has been running about 850,000 bbl. daily.

Crown Prince Saud is the eldest son of 73-year-old King Ibn Saud whose health is failing. Early this month, the king set up the country's first cabinet headed by the crown prince as prime minister, and, with the king's condition reported worsening, there have been reports he may abdicate in favor of the prince.

Reports in the industry are that the Aramco-government negotiations over revision of the company's concession contract have again been postponed until the latter part of the year. The Saudi Arabian government is seeking more revenue and presumably whatever settlement is reached later would be retroactive to an agreed date.

Hoover Arrives in Iran

Herbert Hoover, Jr., has arrived in Teheran on what is described as a fact-finding mission in the British-Iranian oil nationalization dispute.

On his arrival in the Iranian capital, the special adviser to the U. S. State Department on oil problems told reporters he had no new proposals to offer on behalf of either the British or the American governments.

It seemed plain Hoover's trip was for the purpose of sounding out the new Iranian government of Prime Minister Zahedi on how far it is willing to go to reach a settlement. An American source in Teheran said Hoover would go to London probably the end of this week and he might shuttle between Washington, Teheran, and London for the next 2 or 3 months.

British officials particularly have refrained from any new expressions of hope for a settlement since Zahedi came to power. The British continue to stand on their basic demand for adequate and effective compensation and it is recognized that nationalistic and anti-British feeling is still strong in Iran, despite efforts of the Zahedi government to bring home to the Iranian public the deterioration of the industry and the country's economy during the Mossadegh regime.

Suez-to-Cairo Line Approved

Specifications for a products pipeline from Suez to Cairo have been approved by the Egyptian cabinet, and £E2,000,000 (about $5,800,000) has been earmarked for the project.

Bids for construction of the line are to be asked on an international basis. The funds will be provided over a 2-year period, and for the current fiscal year, half the total sum is provided in the budget of the Egyptian State Railways.

The Egyptian government has published in Cairo the text of a law establishing a board to operate the government's refinery at Suez. The group is composed of officials and technicians nominated by the various ministries, and will handle the day-to-day routine operation of the plant. Decisions regarding the refinery which affect national interest will be referred to the cabinet for approval. The government is studying a plan to organize a joint stock company, 51 per cent state-owned, to control the refinery.

Tanker Rates Continue Drop

The continued slump in tanker charter rates has resulted in another drop in the semiannual Broker's Award.

The award is set by a panel of tanker brokers in London as the rate for a standard 12,000-ton tanker chartered for 2 years. It provides a more stable determination of rates than the sharply fluctuating spot market and is used in arriving at the transportation factor in the price of oil sold abroad.

The panel set a figure of 18s 6d, equivalent to $2.59 per ton deadweight per month for the 6-month period beginning October 1. This represents a reduction of 17 per cent from the 22s 3d, or $3.12, rate fixed for the previous half-year period. For the October-April period a year ago, the figure was 42s 3d, or $5.92. The latest award is a reduction of nearly 40 per cent as compared to the year-earlier assessment.

A.I.M.E. Sets Attendance Record

New techniques in drilling, completing, oil-production engineering, and gas described before more than 1,700

K. B. Barnes and Ed McGhee

DALLAS.—The Adolphus and Baker hotels here were literally overflowing with concurrent sessions of the fall meeting of the Petroleum Branch of the American Institute of Mining and Metallurgical Engineers October 18-21.

Technologists from every oil state in the country were in attendance for what turned out to be the largest meeting in the Petroleum Branch that the A.I.M.E. has ever held.

The Oil and Gas Journal published and distributed at the meeting a registration list of all attendees. The 1,700-plus tabulation topped the Journal's previous listing for the meeting the year before at Houston (1,533) and the preceding one at Oklahoma City (1,025).

During the 4-day sessions at Dallas, 43 engineering papers were presented, divided into 11 groups, at different meetings held concurrently at the two downtown hotels. These groups included field case histories, production equipment, drilling fluids, reservoir fluids, production operations and geological engineering, logging, secondary recovery, well completion, and natural gas technology, reservoir mechanics, economics and management.

The Dallas Section and fall A.I.M.E. meeting committee heads were: E. R. Brownscombe, Atlantic Refining Co.; J. H. Murrell, DeGolyer & MacNaughton; R. J. Bradley, Bradley, Oliver & Associates; R. J. Bethancourt, Sun Oil Co.; Kenneth Robbins, Otis Pressure Control, Inc.; Douglas Ball, consultant; Brad Mills, American Association of Oilwell Drilling Contractors; Ruford Maders, Republic Natural Gas; R. T. Bright, Mercantile National Bank; and Tom Morton, Halliburton Oilwell Cementing Co.

Highlights of the Dallas A.I.M.E. technical papers appear in the summarizations, classified by subject, appearing on this and the following pages.

Drilling Fluids

Phillips Centrifuge Removes Drilled Solids in Mud

DRILLING mud in any circulatory system is made viscous and difficult to pump by gradual accumulation of drilled solids which pass through the shale shaker and are continually reground.

In a weighted mud containing a large proportion of barite by volume, the amount of drilled solids that may be tolerated is greatly reduced.

At the termination of drilling, mud highly contaminated with light solids and spent chemicals is poorly suited for completion operations and is limited in utility for other drilling operations.

When actually applied on a drilling rig, a decanting-type centrifuge to separate and reject the low density solids from the weighting materials results in a drilling mud of greatly improved quality with lower values of yield and rigidity.

Chemicals' use cut . . . Its practicality and economy has been proven in field operation. The degree of separation of light and heavy solids is not limited by the machine but by the particle-size distribution of the solids in the mud. Removal of the low-density component of drilling mud that makes chemical treatment necessary permits a marked reduction in chemicals.

The main uses of the centrifugal process are the treatment of muds while drilling, the reclaiming of discarded muds, cleaning up of workover muds, and the reduction in lime content of mud for completion.

The centrifuge will accomplish the following:

1. Maintain the desired flow properties of weighted drilling muds without resort to continual discarding and rebuilding substantial portions of the mud in the circulatory system.
2. Greatly reduce the quantity of chemicals required for treatment.
3. Reclaim and concentrate used muds to densities up to 24 lb. per gallon.

Properly installed and supervised, the machine will require little maintenance and attention. Highly efficient separation may be obtained with the decanting type machine, resulting in low barite loss.

ROY A. BOBO and **R. S. HOCH**, Phillips Petroleum Co., Houston.

Magnolia Cuts Drill Costs By Applying Mud Experience

SINCE March 1945, Magnolia Petroleum Co. has drilled 39 wells in Southwest Coastal Louisiana, within a comparatively small radius but with a large variety of problems.

The deepest was 13,518 ft., and total depth of all wells averaged 10,977 ft.

Over this period drilling mud control and types of mud handled were: (1) phosphate, (2) red lime (late conversion), (3) red lime starch (early conversion), (4) red lime starch oil emulsion, (5) precision controlled low alkalinity-low lime content, and (6) gel muds for completion purposes.

Improvement has been obtained in effecting some or all of the following: (1) more rapid penetration, (2) reduction in drilling hazards, (3) better evaluation of cores and logs, and (4) better completions.

The knowledge accumulated during the period was applied in planning and concluding the drilling of three wells in Chalkley field, in which are found the most severe drilling hazards of any of the fields involved. The experience gained in drilling the first two wells in that field enabled the drilling of the third well with a 31 per cent reduction over the previous wells in both drilling and drilling-mud costs.

Many kinds of mud systems were employed in drilling the wells, each of which has its merits, but there is no one type that can be satisfactorily used for all purposes. From an economical standpoint, the lime-treated mud offers numerous advantages.

Cost reduction is vitally necessary in any drilling operation, but it is particularly important in the development of structures where abnormally pressured, relatively thin producing-sand zones are marginal in calculated pay-out.

C. R. CLAUS and **G. A. STANDISH**, Magnolia Petroleum Co.

New Drilling Mud Cutting Mud Costs 20-50 Per Cent

A NEW drilling mud called "Conoco M-I Lime Mud" cut mud costs by as much as 20 to 50 per cent recently when used in five wells drilled to 11,000 and 12,000 ft. in the same field.

The saving is a result of adding lesser amounts of chemicals.

It was concluded that a mud with low caustic content is desired and that the most efficient thinner for use in a lime system is calcium ligno-sulfonate. Further, if the maximum thinning efficiency from lime is desired, a concentration of from ½ to 2 lb. per bbl. should be used.

Accordingly, a laboratory mud was mixed using 2 lb. per bbl. of lignox, 2 lb. per bbl. of lime, and 2 lb. per bbl. of caustic.

Testing of the laboratory mud showed that it had a resistivity of 2.6 ohmmeters, would tolerate gyp, anhydrite, or cement, and could withstand 50,000 to 75,000 p.p.m. of salt. Further, the mud would not gel at high temperature, a sample heated at 350° F. for 6 months being thinner than when originally mixed.

Field tests . . . Continental has four wells being drilled with Conoco M-I Lime Mud. No trouble has been encountered with the mud either in the "breakover" or in keeping it in condition after "breakover." In one of the wells the mud was used while drilling through 700 ft. of cement with no trouble.

Maintenance has been as easy as with a conventional lime mud, the difference being that considerably less chemical and lime are used.

The calcium ligno-sulfonate is used as a dispersant during the "breakover" enabling the use of quebracho as a thinner should it be necessary to obtain additional thinning.

"Breakover" to the new mud is made any time after the surface string has ben set. Ordinarily with 1.5 to 2 lb. per bbl. of calcium ligno-sulfonate, .2 lb. per bbl. of caustic, and 1 lb. per bbl. of lime. This yields a pH of from 11.0 to 11.5. Water loss is controlled by the use of CMC.

Control effected by using chemicals used regularly in lime muds. The difference is in the amounts used. For example, the lime treatment for this mud will range from 50 to 300 lb. per day. Viscosity control is maintained by quebracho or calcium ligno-sulfonate with possibly 25 lb. of caustic used

Higher Gasoline Yields and Increased Cracking Capacity with YORKMESH DEMISTERS in Vacuum Towers....

YORKMESH Demisters are answering Petroleum Engineers' demands the world over for simple means of improving the performance and increasing the throughput capacities of catalytic cracking units.

Yorkmesh Demisters in Vacuum Towers remove substantially all liquid entrainment even at increased vapor velocities—the gas oil then produced has lower carbon content—the reduced metals content accounts for continued high catalyst activity. The net result is more gasoline of higher octane rating.

Yorkmesh Demisters are used equally successfully to improve the performance of gas absorbers, scrubbers, separators, evaporators, knock-out drums, etc.

Easily installed in existing or new equipment.—Materials: Types 430, 304, 316 stainless, monel, carbon steel, etc.—Prompt shipment.

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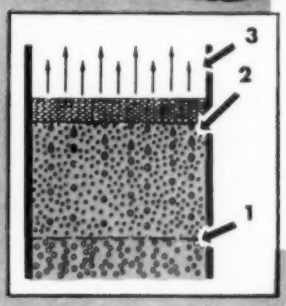

1. *Vapor disengaging from liquid creates fine liquid droplets which are carried as entrainment by the vapor stream.*
2. *The liquid droplets impinge on the fine wire surfaces of YORKMESH, and are coalesced into large drops which run down and fall off the YORKMESH.*
3. *The vapor is now dry. It has been entirely freed from entrained liquid. Thus a clean gas-oil goes to the catalytic cracker.*

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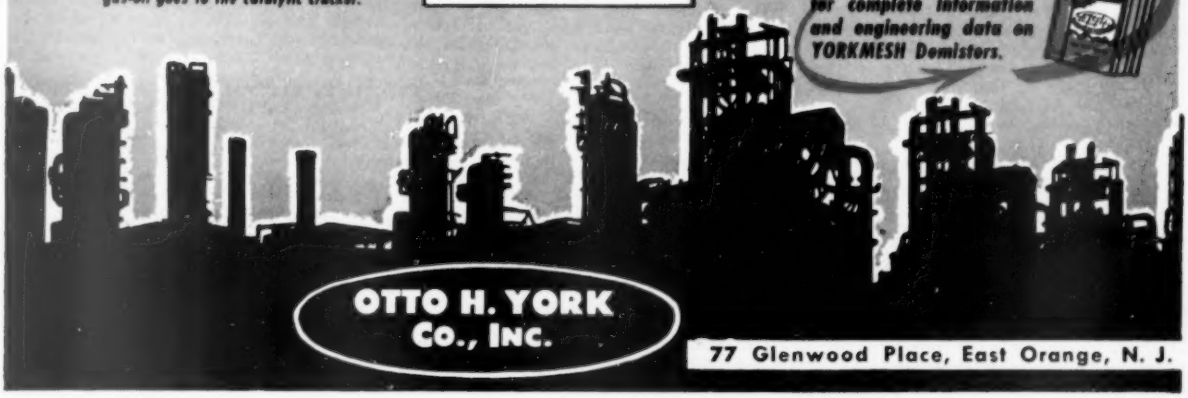


OTTO H. YORK CO., INC.

77 Glenwood Place, East Orange, N. J.

per hour and the pH is maintained between 9.5 and 11.5.

Field tests to date indicate that the M-I Lime Mud is much more versatile than conventional lime mud in that it can be treated to meet any desired situation. For example, if cement or anhydrite is drilled, the pH of the mud may be raised to 12 or above by addition of caustic soda to reduce the solubility of the cement and anhydrite. Similar procedure would be employed if salt water was encountered, since the mud will tolerate more salt as the pH is raised.

HENRY J. COFFER and **ROSCOE C. CLARK, JR.**, Continental Oil Co., Ponca City.

Field Case Histories

Pressure Maintenance in Brookhaven Field Successful

THE program of pressure maintenance in Brookhaven field, Mississippi, is considered to be a success in that expected ultimate recovery has been increased and the current rate of production is in excess of 2 per cent of original oil in place per year.

Performance has been better, anticipated ultimate recovery is larger, and total production costs are lower than for a similar reservoir nearby even though that field appears to have more effective natural water drive.

Brookhaven field, one of several basal Tuscaloosa reservoirs located in South-Central Mississippi, is a sandstone reservoir, of erratic deposition, with several faults, having an approximate subsea depth of 9,800 ft.

A large variation in permeability exists with a weighted average being 256 md. Estimated average interstitial water saturation is 45 per cent. The undersaturated reservoir fluid exhibits marked differences in physical properties with measured saturation pressures ranging from 733 to 2,255 psi.

Rapid decline . . . Early rapid decline in reservoir pressure caused the operating interests to unitize the field and initiate a program of pressure maintenance by gas injection. At the time gas injection was commenced, the reservoir pressure had fallen to nearly half of the original pressure when only 4.5 per cent of the original oil in place had been produced.

The reservoir pressure has since been maintained at approximately 2,750 psi. and cumulative production to date is 17 per cent of original oil in place.

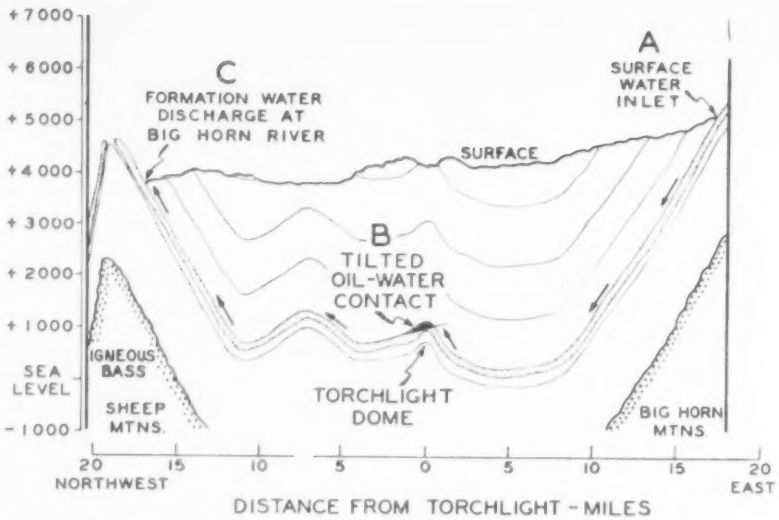
J. B. JUSTUS, R. W. CASSINGHAM, C. R. BLOMBERG, and **W. H. ASHBY, JR.**, The California Co.

Water Drive: Outcrop to Oil Reservoir to Outcrop

THE water table at Torchlight Tensleep Reservoir, Wyoming, is tilted 160 ft. per mile, corresponding to a head of 23 ft. in the aquifer.

The producing formation, the Tensleep sand, takes water at one outcrop and discharges at a lower exposure. For this reason, the reservoir which is between the outcrops is subject to a dynamic head and to a tilted water table.

The Torchlight Tensleep reservoir is a small field in a large aquifer, and reservoir oil is greatly undersaturated, having a bubble point of only 55 psi. and 2 cu. ft. per bbl. of gas in solution. Changes in the reservoir volume factor in the range of pressures encountered are small, meaning little error in converting production to reservoir conditions.



UNUSUAL TILTED WATER TABLE of Torchlight Dome oil field in Wyoming. Surface water enters the Tensleep sand at outcrop A and gravitates past the reservoir at B. Excess water flows into Big Horn River at outcrop C. (Drawing by permission of Stanolind Oil & Gas Co.)

The pressure has declined from 1,618 psi. initially to 137 psi. during the first 4½ years. Water production has been negligible.

Reserve estimation . . . In view of its small size, the absence of a gas phase, large pressure drop from the initial, and rapid pressure-rate adjustments, the reservoir lends itself readily to estimation of oil in place and water influx by various methods commonly used for analysis of water drive fields.

In general oil production increased rapidly to a peak within a few months after discovery followed by a period of rapidly decreasing rate as reservoir pressure and well capacity declined. Production rate was then reduced below capacity during 1949, and reservoir pressure responded by increasing rapidly.

Production was increased in February 1950, and since mid-1950 has been at well capacity. Withdrawals during this latter period are directly related to and controlled by the rate of water influx.

F. M. STEWART, F. H. CALLAWAY and **R. E. GLADFELTER**, Stanolind Oil & Gas Co.

Production Equipment

Free Gas Said Basic Cause Of Low Pump Efficiency

THE basic cause of low volumetric efficiency of an oil well pump, in good mechanical condition, is the presence of free gas in the pumped fluid.

Gas is effective in lowering efficiency for two reasons: (1) pump volumetric efficiency is based only on liquid pumped, and (2) gas is very compressible, requiring considerable travel of the pump plunger to obtain valve action.

Gas compressibility would not be important if there were no space for fluid to remain between the traveling and standing valves at the position of their closest approach. In this event, all fluid in the pump barrel would be pumped.

However, there must always be a clearance between the valves at their closest approach. A compressible fluid in this space may expand from the pump discharge pressure to the pump intake pressure and occupy a portion of the pump barrel which has been traversed by the pump plunger.

Any portion of the pump barrel traversed by the pump plunger that is occupied by expanded fluid from the clearance space represents a loss of efficiency in the pump. Therefore, the ratio of the clearance volume to the volume swept out by the pump plunger would be expected to affect the volumetric efficiency of a pump handling gas.

Effect of pump speed . . . Pump speed was found not to have much effect on volumetric efficiency in pumps in good condition and operating in a clean fluid. However, in a field installation where worn valves may be operating in dirty fluids, valve action may not be efficient.

As pump speed increases, the number of valve actions increases, and valve action must be efficient for good volumetric efficiency. For this reason there is a good possibility of a decrease in efficiency with an increase in pump speed in actual field installations.

In field installations, as pump stroke length is increased, the pump clearance volume usually remains constant and therefore the clearance ratio decreases, tending to give increased pump efficiency.

C. A. CONNALLY, C. R. SANDBERG, member A.I.M.E., and **N. STEIN**, Magnolia Petroleum Co. field research laboratories, Dallas.

Automatic Lease Operation At Weeks Island Described

THERE are basic requirements that must be met to completely produce a lease automatically. First it is necessary to have a tank switcher, which will transfer flow from one tank to another when a predetermined fluid level is reached. It must also operate in such a manner that flow cannot

be transferred to tanks either full or on pipe-line runs.

Another requirement is to control the opening and closing of the wells. It is necessary to close in wells when: (1) No tank space is available, (2) a well is produced on a predetermined schedule, (3) a failure occurs in the producing equipment.

Producing equipment on Gulf's Provost Cyr unit at Weeks Island field consists of four 1,000-bbl. stock tanks, one 500-psi. oil and gas separator, two 125-psi. oil and gas separators, one emulsion-type heater treater, and one horizontal precipitator, all connected with adequate manifolds and piping.

Switching equipment . . . Principal components of the tank switching equipment consists of a tank-switching panel, tank inlet valves, tank float switches, and pipe-line valve switches. All of these items are electrically operated and each tank's installations function as a unit.

On the tank-switching panel, storage space in a stock tank is indicated by a green light. Whenever a tank is filled, the corresponding green light on the panel will go out and flow will be transferred to the next empty tank. No green light for a tank will burn as long as the tank's pipe-line valve is open.

When all of the stock tanks are full, or are being run by pipe line the wells are closed in and this is shown by a full tank light on the control panel and a corresponding light burning on a pole near the separators.

If for any reason one of the oil and gas separators fails to function properly and fills with fluid to a predetermined level, an automatic float switch is tripped and the wells are closed in. A signal of this will be indicated by signal lights burning on the control panel and on a pole near the tanks.

T. P. NORTHERN, Gulf Refining Co., Lafayette, La.

Stanolind Testing New Ball Pump on Problem Wells

A NEW system for intermittent or continuous gas lift which uses rubber balls as pistons to prevent wasteful gas slippage has been developed and is now undergoing exhaustive field tests.

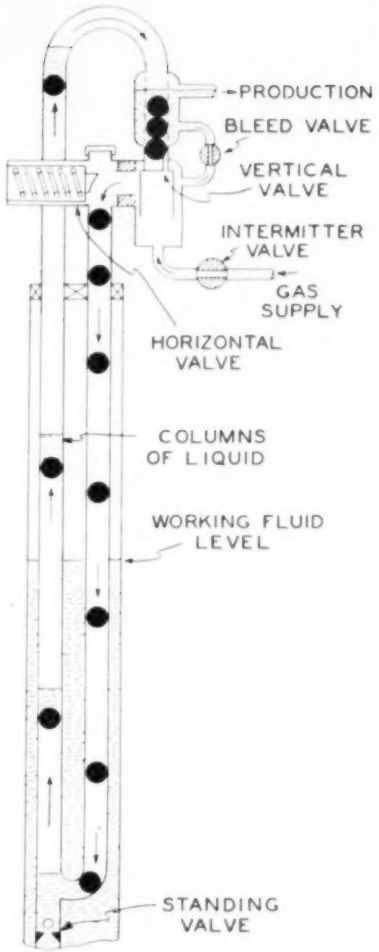
In the system two parallel strings of tubing are used. The rubber balls are forced down one string and the production is lifted up the other. The balls are separated from the oil and gas at the surface and reinjected with the lift gas by a special mechanism at the surface.

Field tests indicate that the pump offers an economical solution for pumping wells where low production, foamy crude, high gas-oil ratio, deep production, or corrosion is a problem.

One unique feature is that adjustments and repairs can be made at the surface by one or two men without heavy equipment.

Requirements for success . . . A new gas-lift system, to be attractive economically, should offer these features:

1. All controls, adjustments, and repairs necessary for operating the lift must be made easily and quickly at the surface.
2. If possible, the initial installation should serve the well to depletion without being removed regardless of how the production characteristics may change.
3. The lift must be made with low gas volume at reasonable pressures.
4. Lifting efficiency should be independent of the characteristics of the well produced fluids.
5. Paraffin accumulation should be prevented.



NEW GAS-LIFT SYSTEM, which can be operated either continuously or intermittently, employs two strings of tubing. Ordinary rubber balls feed automatically through valves in well head into first tubing string, pick up slugs of fluid at bottom of well, carry fluid up second tubing string, discharge it, and re-enter first string. (Drawing by permission of Stanolind Oil & Gas Co.)

6. Inhibitors for control of corrosion must be able to reach all portions of the system.
7. Production should be possible in the deepest wells.
8. The pump should lift low-gravity crudes.

It is felt that the ball-pump gas-lift system fulfills these requirements with only one major disadvantage: two strings of tubing are required. This advantage, however, has been accepted by the industry for dual completions and other means of lift for several years, and it is believed that the advantages of the ball pump will more than offset the additional cost of the extra string of tubing.

R. PRICE VINCENT and **L. B. WILDER,** Stanolind Oil & Gas Co.

Both Corrosion and Erosion Affect Life of Sucker Rods

MORE than 90 per cent of the crude-oil produced by artificial-lift methods is produced through sucker-rod pumping systems. In the United States each year more than $14,000,000 is spent for sucker rods in new and old pumping installations. It is important to make this investment a wise one.

The sucker-rod life, for a given stress pattern and surface, may be considered as being dependent upon both corrosion resistance and erosion resistance.

Where rod wear is not a problem and where corrosive service is encountered, the lower carbon-alloy steels of suitable yield strength levels and quenched and tempered structures would seem preferable.

Where rod wear is a significant factor, the plain carbon and carbon-manganese rods (normalized condition) would tend to confer a desirable erosion resistance and a certain corrosion resistance, both of which should contribute to an improved corrosion fatigue life for this case.

Finally, where neither wear nor corrosive conditions occur the low-carbon alloy or the normalized plain carbon and carbon-manganese steels are indicated, with the former giving the longer life or the larger load-carrying capacity.

The final sucker rod behavior is, in certain cases, dependent on the corrosion-erosion fatigue behavior of sucker-rod steels, with the erosion resistance increasing with increased carbon content and structural hardness.

F. J. RADD and **R. L. McGLASSON,** Continental Oil Co., Ponca City.

Economics

Three Unitization Problems Confront Smaller Operators

WHEN engineers of larger operators deal with regulatory bodies in matters of projects involving smaller operators, consideration should be on a broader base than mere technology. Before presenting a case to such a body, two technical factors should be considered:

1. The practical economics of the proposed project.
2. The state of mind of smaller operators who will be affected by the project.

Obviously the solution is not to help the small operator by penalizing the large operator. To meet these conditions for both small and large operators, a project must not only increase the ultimate recovery, it must also increase the current rate sufficiently to give both small and large operators some incentive.

Small operators' problems . . . Here are the three problems that face almost all small operators, and some that are not so small: (1) For many reasons, among them tax laws, they are almost always using a lot of borrowed money in their operations. (2) Most of these operators will be counting on part of the income from their properties in a unit for certain wildcat drilling projects. (3) Most of these smaller operators are forced to think in terms of selling their producing properties in a unit some time in the future.

The ideal solution for unitization projects, from the small operator's point of view, would meet the following standards:

1. No decrease in operating net income for a minimum of 3 years and preferably 5 years.
2. Pro rata share of capital investment in pressure maintenance equipment carried at not to exceed 5½ per cent interest for 3 to 5 years, then liquidated by income from increased production over what primary recovery would have permitted.

CHARLES J. DEEGAN, petroleum consultant, Dallas.

stop vibration before it starts

with a FLUOR pulsation dampening piping system

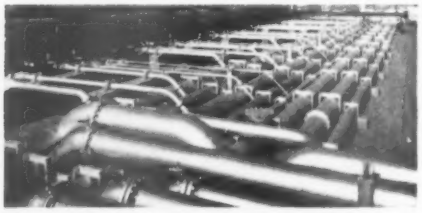
A Fluor Pulsation Dampening Piping System smooths out the "puffs" created by reciprocating action of compressors. It eliminates one of the chief causes of piping vibrations. A smooth, steady gas flow incurs less frictional resistance and reduces line breakage due to pipe fatigue. Without dampeners there is no alternate solution: *no matter how well pipe is anchored, the basic pulsations remain* – to cause problems with metering accuracy and plant safety.

For new construction, Fluor supplies the complete piping system, prefabricated, ready for installation. Pulsation dampening is designed right into the basic compressor system through an engineered selection of bottles, headers and laterals. *It is built in, not added on.* And it costs little more than a conventional system because it eliminates expensive pipe anchoring and allows the design of related equipment based on a system free of pulsative flow.

For existing construction, Fluor's two "package-type" Pulsation Dampeners, in both manifold and in-line types, are easily installed in existing plants with an excessive vibration problem. The Fundamental Dampener minimizes objectionable pulsations while providing the continuous advantages of low pressure drop and less stress on piping, heat exchangers and vessels. The High Frequency Dampeners are supplied where pulse frequencies are in the range of the second harmonic or higher.

Fluor's Mobile Research Laboratory

Manned by capable engineers experienced in the phenomena of sound and vibration, Fluor's Mobile Research Lab is fully equipped to conduct on-the-spot tests to determine the source, extent and best means of eradicating plant piping vibration.



Fluor Pulsation Dampening Piping System built into new compressor station assures accurate metering.

Fluor Pulsation Dampeners curb vibration caused by reciprocating action of compressors.

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Production Operations

New Completion Technique Reduces Costs, Speeds Job

SIMPLIFIED equipment and techniques have been developed to permit cementing a completion interval in a well and recompleting higher, lower, or at the same depth in such a manner as to:

1. Eliminate the need for a conventional drilling or workover rig.
2. Eliminate mud and other cement contaminants which have long interfered with ideal cementing.
3. Eliminate need for drilling out cement.
4. Provide a more satisfactory recompletion.
5. Provide a more economical recompletion.

Squeeze cementing, which was one of the most difficult problems that had to be solved to make permanent completions a reality, is now almost as easy as with conventional workovers.

Extension pipe . . . The technique involves the use of a small-diameter, light-weight, tubing extension which is run on a wire line and set in a landing nipple previously installed in the tubing string. Low squeeze pressure and small cement volumes, with their attendant cost reduction, are successfully used when wells are completed and reworked with salt water or other penetrating fluids.

Relatively low-water-loss cement is an integral component of the technique which provides that excess cement be reverse circulated from the well to leave the casing void of cement when recompleting lower or in the same interval. Substantial cost reductions are realized by using the simplified or low-pressure cementing technique, and the ratio of successful squeeze-cement operations has been increased.

It has been found that it is not necessary to fracture the formation to obtain a successful squeeze, nor is the surface pressure an indication of a successful job.

The use of a cement slurry that remains fluid in the casing permits the casing to be cleaned after the job by circulating to the depth desired.

The simplified low-pressure squeeze-cementing techniques may be performed without rigs, special squeeze tools, or large cement pump trucks, thus making possible a large reduction in recompletion cost.

T. A. HUBER and **G. H. TAUSCH**, members A.I.M.E., and **J. R. DUBLIN, III**, Humble Oil & Refining Co., Houston.

New Slurry Shuts Off Water, Doesn't Harm Oil Production

A FIELD remedial procedure utilizing a kerosine-cement slurry as a water plugoff agent in fractured formations has proved to be capable of effectively shutting off water without causing permanent impairment of the oil production.

Success is attributed to the fact that an immobile cement slurry, when placed in a water-producing strata, will set and form an impermeable barrier; whereas when placed in an oil-producing section the cement will retain a relatively high permeability and may be removed by acidizing.

Placement of a vertical plug in a fractured formation is only slightly effective in temporarily reducing the flow of water. However, as has been shown by electric model flow study, the placing of a plug in a well and an impermeable horizontal streak in the formation will prove to be a means for materially reducing or even eliminating water production in a fractured formation.

Procedure . . . It is found that the squeezing of more than 10 ft. of hole is unnecessary. Generally, the procedure is to break down the formation with oil. In event the formation cannot be broken down and the formation is known to be acid-reactive, acid may be used provided the spent acid is displaced away from the well bore with at least 20 bbl. of oil. The slurry is then displaced into the formation.

If the daily production after 7 days indicates that the oil section has been partially plugged, the zone should be acidized, using sufficient acid to remove the plugging.

GEORGE C. HOWARD, member A.I.M.E., and **P. P. SCOTT, JR.**, Stanolind Oil & Gas Co., Tulsa, Okla.

Secondary Recovery

Five-Pay Flood Under Way In Salem Field in Illinois

SIMULTANEOUS water floods of five-pay horizons are under way in Lake Centralia-Salem oil field, Marion County, Illinois.

The magnitude of this project may be appreciated when it is realized that accumulated injected water will be on the order of 1,680,000,000 bbl. during a 20-year flood life. At peak conditions the total injection requirements may reach 350,000 bbl. daily.

The unitized field embraces an area of 8,800 acres approximately 6½ miles in length and 2½ miles in width. The field has produced 222,000,000 bbl. of oil, while some 15,060,000 bbl. remain to be produced by primary methods. It is estimated that the ultimate secondary oil recovery will be approximately 85 per cent of that recovered under primary production.

The field was producing approximately 8,000 bbl. daily of salt water at the time of unitization. It was estimated that a maximum water-injection requirement of nearly 350,000 bbl. daily would be reached during life of the flood and that make-up water of approximately 185,000 bbl. daily would be needed.

Surface facilities incorporate a maximum of automatic operating and labor-saving devices. Protective systems are included throughout to shut down any phase of operation in the event of failure or disruption of services. They include both audible and visible signals to warn the plant operator of trouble.

A microwave radio system at the plant site is used to selectively control operations of the three vertical turbine pumps in the Ranney supply unit located 17 miles from the field. The microwave system also incorporates voice communication between the two points to facilitate servicing controls and equipment.

An air-operated control system automatically controls the rate of flow through the water treatment plant by increasing or decreasing the flow in each of the respective units as indicated by water level in the clearwell.

REX L. LIVINGSTON, The Texas Co., Salem, Ill.

Texas A. & M. Pushes Work On Water-Flood Research

A STUDY of the effects on oil recovery from a Woodbine sand water flood of the surface tension of brine and the interfacial tension between oil and brine was described by Texas A. & M. College researchers.

Fourteen surface-active agents, which were found to be effective in lowering the surface and interfacial tensions, were investigated to determine the extent of their adsorption by the Woodbine.

Data from the water-flooding interfacial-tension study support the following conclusions for the conditions studied:

1. Reduction of the interfacial tension between oil and brine reduces slightly the recovery of oil by water flooding above the bubble point.
2. At pressures below the bubble point, in the presence of gas, reduction of interfacial and surface tensions of the liquids has a small or negligible effect on recovery. However, the presence of gas, regardless of the surface and interfacial tensions, exerts a substantial beneficial effect on the recovery.
3. No appreciable additional oil can be obtained by water flooding a core which has been previously water flooded above the bubble point and pressure depleted.
4. The adsorption of some surface-active chemicals on Woodbine sand is considerably less in a sand-brine-oil system under reservoir conditions than in a sand-brine system under atmospheric conditions. However, all of the chemicals tested are adsorbed in prohibitive quantities.
5. Surface-active agents that change the wetability of a sand from water-wet to oil-wet may reduce the recovery of oil by water flooding as much as 8 per cent.

HARVEY T. KENNEDY and **ERASMO T. GUERRERO**, Texas A. & M. College.

Fracturing May Either Hurt Or Help Water-Flood Project

FRACTURING can either increase or decrease the effectiveness of a water flood, according to a survey conducted by the Texas Petroleum Research Committee.

The committee found that if a vertical fracture is parallel with the direction of flood, the areal sweep efficiency may be considerably reduced, approaching zero in some instances.

If the fracture is at right angles to the direction of flood, the areal sweep efficiency may be greater than that for the unfractured system. The sweep efficiency depends on the length and orientation of the fracture and direction of the flood.

Knowledge of the nature and direction of fractures before initiating a flooding program is required if the maximum sweep efficiency is to be obtained and channeling is to be reduced to a minimum.

Model studies . . . Potentiometric model studies have been made of the areal sweep efficiencies of vertically fractured, line-drive patterns at a mobility ratio of one. In every case the fractures originated at the well and

extended into the reservoir for various distances. The areal sweep efficiency was found to vary from near zero to 100 per cent depending on the length and orientation of the fracture and direction of the water flood.

A decrease in areal sweep efficiency was obtained where the fracture was parallel to the direction of the flood. If the fracture extended half the distance between wells a sweep efficiency near 28 per cent might be expected for the particular pattern studied here.

Increased efficiency . . . An increase in areal sweep efficiency was obtained where the fracture was perpendicular to the direction of flood. Very high sweep efficiencies were obtained for the case of equal and opposite parallel vertical fractures. In this case theoretical areal sweep efficiencies near 100 per cent may be approached. For a given vertically fractured system, a 90° change in the direction of the flood may alter appreciably the oil recovered at break-through.

If a flooding scheme cannot be devised whereby the fractures are utilized to increase the sweep efficiency, then some consideration should be given to remedial measures.

PAUL B. CRAWFORD and **R. E. COLLINS**, Texas Petroleum Research Committee, College Station, Tex.

Frio Repressuring Cost Less Than .01 of Oil in Place

COST of repressuring the D-5 reservoir in the Frio sands of South Texas has been far exceeded by the realization from the project.

Roughly 10,323,000 M.c.f. of gas was injected in the past 12 years at a cost of approximately 4 cents per M.c.f. or $413,000. Using $2.00 per barrel as the value of the oil after royalty, taxes, and lifting costs, the above cost would be equivalent to 206,500 bbl. of oil.

Therefore, the cost of injection operations to date would be paid out by an increase in recovery of less than 1 per cent increase of the 21,742,000 bbl. of the original stock-tank oil in place. Comparison with other reservoirs in the field indicate the increase in recovery to date has been greater than this amount.

Both favorable and unfavorable conditions for a gas injection project are present in this reservoir. Favorable are the large leases and the control of the reservoir and plant by one operator. There was an adequate gas supply without outside purchases. Under proration the gas production of high gas-oil ratio wells was reduced, thus eliminating excessive gas production and conserving reservoir energy.

An advantage peculiar to Gulf Coast fields is the higher price for crude oil. Recent posting for 40-gravity crude being $3.15 per barrel for the subject field.

Unfavorable factors . . . Two major factors which were not favorable for gas injection were the nonhomogeneous nature of the sand and the irregular shape of the reservoir.

According to material balance calculations, the recovery without injection would have been less than 20 per cent of the original oil in place, and the reservoir would have been essentially depleted by now. By comparison, the recovery to date with injection has been greater than 25 per cent of the oil in place and the reservoir is still producing 800 bbl. daily.

The benefits which have been derived from gas injection in the subject reservoir may be summarized as follows:

1. Deferment and reduction of artificial lift equipment.
2. Sustained rate of production.
3. Increased economic oil recovery.

B. T. MILLIKIN, JR., Continental Oil Co., Ponca City.

Reservoir Mechanics

Three Methods Presented to Obtain Vital Flood Data

FOR economic exploitation of oil fields both the sound control of primary-recovery processes and the proper application of secondard-recovery methods are essential. Detailed information as to the relevent flow processes and variables are required.

Three methods can obtain this information: (1) Statistical analysis of field data; (2) Scaled model experiments; (3) Mathematical analysis.

The most profitable procedure appears to be:

A. Determining the fundamental relations for idealized reservoirs by methods (2) and (3).

B. Checking the consistency of these two methods.

C. Establishing range of applicability of these methods to actual reservoirs by comparison with data accumulated under (1).

Qualitative results have confirmed that the oil-water viscosity ratio is one of the major factors governing the efficiency of the displacement process.

G. A. CROES and **N. SCHWARZ**, De Bataafsche Petroleum Maatschappij, The Hague, Netherlands.

Well Completion

Gulf Reports Three-Fold Profit From Gravel Packing

EXPERIENCE with the "pressure pack" method of gravel packing indicates that sand free, fluid production can be maintained for a length of time sufficient to make the operation economically attractive. Data pertaining to the first 15 wells so completed by Gulf indicate that for each dollar spent to effect the completion, there will be a return of more than $2.92.

The pressure pack technique of gravel packing is essentially the placing of gravel in and adjacent to the producing formations. This is done with fluid pressure and by the use of a drill fluid that will permit partial or complete loss of returns to the formation during placement.

Other advantages . . . Other advantages claimed for this type of completion are that the pressure placement of the gravel has a scouring effect on the casing perforations, that additional drainage channels to the well bore are created, and that the possibility of shifting of the formations adjacent to the casing is minimized and possibly prevented.

Success of gravel packs to prevent or retard the migration of unconsolidated sands into the well bore is insured by three factors: (1) the use of a saline or nonaqueous, nonsolids drill fluid, (2) proper preparation of the well bore prior to gravel packing, and (3) pressure placement of the gravel.

C. J. RODGERS, Gulf Oil Corp., Houston.

Shooting Process, Mud Cause Gun Perforation Plugging

LABORATORY experiments under simulated well conditions have demonstrated considerable plugging of perforations made with available gun perforators. This plugging comes apparently as a result of factors associated with the shooting process and/or the drilling mud in the well at the time of perforating.

The restriction to flow per unit of hole depth caused by this plugging appears to be greater for jet perforators than the bullet guns of comparable diameter; however, because of the greater depth of penetration obtained with the jet guns, the total flow rates appear to be approximately equal.

Limited testing with an experimental shaped charge suggests that less shot hole restrictions and greater flow rates may result from larger-diameter perforations or other factors related to charge design.

Gun perforators are currently available which are capable of providing sufficient penetration for most perforating jobs, and, in many cases, sufficient to provide productivities equivalent to or greater than open hole.

It has been noted that in general the bullet perforating process is more adversely affected by heavy casing, hard cement, and hard formation than is the jet perforating process.

One possible step toward increased productivity for perforated completions is the design of shaped charges which will give a larger diameter hole and a deeper penetration than that obtained with the bullet gun. A 29-gm. experimental charge tested is a move in that direction; however, it is not yet known whether merely increasing hole size reduces plugging with jets, or whether the plugging effect may be a function of other factors related to charge design.

T. O. ALLEN, member A.I.M.E., and **J. H. ATTERBURY, JR.**, Humble Oil & Refining Co., Houston.

Study Shows Big Majority Of Fractures Are Vertical

RESULTS of an Atlantic Refining Co. investigation indicate that a large majority of pressure-induced well-bore fractures are vertical, particularly in deeper wells; and that during the extension of fractures, rather large fracture volumes are temporarily created by the parting of the formation.

When well bores are subject to sufficiently high pressures from any source, fracture of the formation surrounding the well occurs. This phenomenon is a common cause of lost circulation during drilling operations, a deliberately planned factor in most squeeze cementing operations, and the controlling factor in many productivity stimulation operations.

Horizontal depth limited . . . Fractures may be horizontal when the bottom-hole fracturing pressure has exceeded the overburden load of about 1 lb. per square inch per foot of depth. Vertical or nearly vertical fractures are obtained at bottom-hole pressures below the over-burden load and frequently below 0.7 psi. per foot of depth.

For these reasons, squeeze cementing cannot be counted upon to result in horizontal

pancakes. Similar reasoning might also explain frequent cases of well stimulation treatments fracturing to water.

Fracture volume estimations are consistent with observations of volumes pumped into formations and may explain large lost-circulation losses without postulating subterranean caverns.

It may also be shown that in the cases in which a consolidated sand is bounded by nonbrittle shales, the vertical extent of vertical fractures would be limited by the shale because of the greater horizontal stresses in the shale.

W. J. McGUIRE, JR., EUGENE HARRISON, and **W. F. KIESCHNICK, JR.,** Atlantic Refining Co., Dallas.

Permeability Said to Be No Longer Vital to Recovery

RECENT work shows that even in formations with a permeability as low as 0.1 md., large fracture treatments can yield oil recoveries and production rates approaching those of high-permeability formations.

These findings mean that in the search for oil, less attention need be given to the permeability of reservoir rocks. It is necessary only to find saturated pore space of sufficient quantity.

If sufficient permeability does not exist in the reservoir rock for production at commercial rates, the oil can still be recovered at attractive rates of production by creating a long radius fracture.

It may be shown that fractures of the size needed in very low-permeabilty formations are well within the reach of present-day treating practices; that the tighter the formation the larger the fracture created under any given set of treating conditions; and that fracture radius increases with increasing injection rates (pump trucks) and fracturing fluid volumes.

Viscous mediums . . . Also the higher the fracturing fluid viscosity and the larger the volume of fluid, the larger will be the fracture created. Permeability inversely affects the fracture radius, that is, the lower the permeability the larger the fracture.

In order to increase substantially commercial recovery from extremely tight formations (capacity less than about 50 md.-ft.), it is necessary to make a fracture long enough that an appreciable part of the reservoir rock flanks the fracture. Long fractures in tight formations in addition to increasing recovery, will permit relatively high rates of production over most of the well's producing life.

L. E. WILSEY and **WILLIAM G. BEARDEN, JR.,** A.I.M.E., Stanolind Oil & Gas Co., Tulsa.

Logging

Electric Logs Can be Made To Show Oil in Shaly Sand

IN spite of the progress which has been made in the last decade toward better utilization of the electric log, there remain a number of problems in the interpretation of the log.

One of these which is often troublesome is that of divining the nature of the fluids in sandstones or carbonate rocks which contain appreciable amounts of shale.

The approach to the problem of deciding whether a shaly zone may contain hydrocarbons, consists of first estimating the resistivity of the stratum filled only with formation water and of then comparing this resistivity with the resistivity indicated by the electric log. If the latter is significantly higher it is logical to assume the presence of oil or gas.

It is possible to estimate the resistivity which the shaly zone would have if completely saturated with formation water, by use of values expressed in terms of the potential read from the electric log. This would require reference either to a shale base line or to the value for a clean sand or carbonate in the immediate vicinity of the bed of interest.

What is needed . . . If a clean sand is used as a reference for the potential, it is necessary to know: (1) The resistivity of the mud filtrate, (2) the resistivity of the formation water, (3) the resistivity of the invaded zone, and (4) the difference in potential read opposite the clean sand and the bed of interest. If the shale base line is used as a reference, it is not necessary to know the resistivity of the formation water or of the mud filtrate.

Investigations reveal that:

1. The adsorptive characteristics of shaly reservoir materials can be used to relate the Mounce potential and abnormal conductivity of these materials.

2. The resulting relations may be used qualitatively to estimate whether or not a particular shaly stratum contains oil or gas.

3. These relations may also be used in the estimation of porosity of shaly sands.

F. M. PERKINS, JR., H. R. BRANNON, JR., and **W. O. WINSAUER,** Humble Oil & Refining Co., Houston.

Method Found to Interpret "Dirty Sand" Electric Logs

THE importance of the so-called "dirty sand" or "conductive solids" problem in electric-log interpretation has generally been recognized. While contributing to the theory of the problem, past research papers have not offered any practical solution.

An experimental investigation has been made of the effects of ion-exchange materials on the electrical properties of natural and synthetic porous media. The method used to make synthetic dirty sands is novel and has proved a most valuable guide to a better understanding of the properties of dirty sands generally.

The effects of ion-exchange materials on both the resistivity and self potential logs have been examined. From the data obtained it has been possible to formulate a simple, practical method whereby electrical logs of dirty sands can be interpreted.

The method is in all essentials identical with that presently in use for interpreting clean sands.

It has been found that:

1. The true formation factor of a dirty sand (the formation factor applicable to the voids capable of containing oil) is not a quantity capable of simple measurement.

2. A formation factor measured when a dirty sand is saturated with a high conductivity fluid is related to the geometry of the water in the voids which could contain oil and to the so-called "bound" water within shale and clay aggregates.

3. As an approximation in moderately dirty sands and provided muds of resistivities of the order of 1 ohm-meter or less at formation temperature are utilized, the analysis of the electric logs of dirty sands may be carried out in precisely the same way as that utilized for logs of clean sands. In this procedure the apparent resistivity of the interstitial water in the dirty sand and the apparent formation factor of the dirty sand must both be obtained from log records. It is not permissable to utilize information based on analysis of produced water samples or cores.

M. R. J. WYLLIE and **P. F. SOUTHWICK,** Gulf Research & Development Co., Pittsburgh.

Value of Various Logs for Thick, Thin Beds Analyzed

CONVENTIONAL resistivity logs consisting of a short normal, a long normal, and one or more long lateral curves do not give data that can be used quantitatively in beds thinner than 20 ft.

Reservoir rocks usually exhibit zones of continuous homogeneity of quite limited thickness where the long lateral curves become useless because of adjacent bed effects and boundary phenomena.

If the beds are 12 ft. or thicker, the short and long normals may be used for qualitative interpretation, which can be streamlined by the application of simplified departure curves. For beds of a thickness less than twice the long normal spacing, this procedure breaks down.

The combination of the limestone curve, the laterolog or guard electrode log, and the microlaterolog permits quantitative interpretation for beds that are at least 8 ft. thick, provided the mud resistivity and the hole diameter are known with sufficient accuracy.

For beds thinner than 8 ft., combinations of the microlaterolog with short spaced laterologs and pseudo laterologs appear promising.

LEENDERT DE WITTE, Continental Oil Co., Ponca City.

Gas Technology

Gas Well Back Pressure a Valuable Calculation Aid

A NEW method for calculating possible combinations of effective permeability, porosity, and well-bore radius from natural-gas well back-pressure test data has been developed.

Calculations show that values of n, the reciprocal of the slope of the back-pressure curve, greater than 1.0 are possible for tests conducted by beginning at the highest flow rate and proceeding to the lowest rate.

The slope of the back-pressure curve apparently is affected by two major factors. The value of the slope depends in part on the effect of turbulence near the well bore and in part on the shifting radius of drainage during the test, as well as other factors which vary with the particular well. Charts which permit correction of the back-pressure test data for the shifting radius of drainage can be drawn.

These performance curves permit the calculation of flow rates and pressure drops at any radius of drainage. Considerable simplification of the calculations is obtained by use of available unsteady-state flow, pressure-gradient plots. The necessity for more data in addition to that given in a back-pressure test is becoming apparent.

DAVID CORNELL, Texas Petroleum Research Committee, Austin.

PERSONALS

Vaughey Honored

New association president is veteran in oil industry

IF the new president of the Independent Petroleum Association of America wasn't literally born in the oil industry, it was so close that oil was almost hereditary for William Meagher Vaughey, and he has spent his adult life in the industry.

Born September 16, 1904, at Marseilles, Ill., Vaughey moved to Tulsa in Indian Territory days with his father, E. A. Vaughey, an independent oil operator who developed production near Bartlesville.

The family later moved to Albuquerque, N. M., where he attended schools and gained his first business experience selling securities in Los Angeles. In 1925, however, he deserted the securities to return to Tulsa and follow his father in the oil business.

Vaughey joined Philmark Oil Co. in Tulsa and later became a scout for the firm covering Oklahoma and the San Angelo area of Texas. When a series of Philmark mergers evolved the Independent Oil & Gas Co., Vaughey remained with the firm. He opened the Oklahoma City office for Independent and managed it until another merger with Phillips Petroleum Co. abolished Independent and he moved to Pennsylvania, where he engaged in land and lease operations for a subsidiary of Electric Bond & Share.

In 1937 he formed the firm of Vaughey & Vaughey with his brother, Emmett, and opened headquarters in Houston. He became active in Mississippi in the early days of that state's petroleum development and eventually the firm's offices were moved to Jackson, Miss., where they are located at the present time.

W. T. Blackburn became a member of the firm shortly after its organization and when the company's operations were extended to the Colorado area, Blackburn established a Denver office. The firm is now active in developing producing properties in Mississippi, Louisiana, New Mexico, Colorado and Nebraska.

A long-time member of I.P.A.A., Vaughey served as a member of the association's executive committee from 1945 to 1948. He has served as a director and vice president for Mississippi. Vaughey headed the important constitution and bylaw committee of the I.P.A.A. for 2 years and was elected president of the association at the twenty-fourth annual meeting at Fort Worth last week.

Donald R. Lindsay, exploitation engineer for Shell Oil Co., has been transferred from Casper, Wyo., to Ventura, Calif.

Fred D. Spindle, geologist for Ohio Oil Co., has been transferred from Holyoke, Colo., to Fort Collins, Colo.

S. G. Dolman has resigned his position as district supervisor of the oil and gas division of Honolulu Oil Corp. at Santa Maria, Calif., and has opened offices in Santa Barbara as a consultant.

John C. Meyer, area geologist for Deep Rock Oil Corp., will be transferred from Bismarck, N. D., to Billings, Mont., November 1. The company's area office for the Williston basin is being moved from Bismarck to Billings.

Dr. Blaine O. Schoepfle of Sandusky, Ohio, and **Leopold A. Robillard** of Montreal, Que., have joined the research and development department of Hooker Electrochemical Co. Dr. Schoepfle has been assigned to the firm's plastics and resins group, and Robillard is with the pilot-plant development group.

Ken Kridner has joined Colorado Interstate Gas Co. at Colorado Springs, Colo., as assistant superintendent of measurement and regulation. He had been with Stanolind Oil & Gas Co. for 6½ years and was contract engineer in the gas-sales section of the firm's production department at Tulsa.

W. Grapes,, drilling superintendent for Falcon Seaboard Drilling Co.'s Louisiana division, has been transferred from Jennings, La., to Lafayette, La.

R. B. Rodgers, formerly general superintendent of pipe lines and river terminals for Standard Oil Co. (Ind.), has been named assistant manager of the sales operating department.

Louis H. Klinzing, senior petroleum engineer for Stanolind Oil & Gas Co. at Tulsa, has retired. He had been with Stanolind since 1936.

Frank W. Reeves has resigned as district geologist for Husky Oil Co. at Midland, Tex., to join Leland Fikes, independent operator, as a petroleum geologist and engineer at Dallas.

F. Truett Neese, seismograph engineer for Carter Oil Co., has been transferred from Sparta, Ill., to Lusk, Wyo.

J. G. SPRATT

J. Grant Spratt, head of Anglo-Canadian Oil Co., Ltd., Calgary, Alta., and a director of Trans Mountain Oil Pipe Line Co., has been named president of Trans Mountain, effective next January 1. He will succeed **R. L. Bridges,** who will continue as a director. Spratt has been associated with Anglo-Canadian for 15 years and has been president of that firm since May 1953. He will resign as president December 31 but will continue as a director.

F. T. Connolly, Tulsa, has been promoted to senior geologist by Shell Oil Co.

Fred P. Matlack, engineer with M. W. Kellogg Co., process engineering-contracting firm, has been transferred from Baytown, Tex., to Nederland, Tex.

W. S. McAlister, formerly associate geologist for Pan-Am Southern Corp. at Shreveport, La., has been promoted to district geologist, replacing **C. Lane Sartor,** who has been named manager of the land department. **W. R. Turner,** formerly assistant geologist at El Dorado, Ark., has succeeded McAlister as associate geologist at Shreveport. McAlister joined Pan-Am in 1950 and Turner in 1951.

PERSONALS

Committee Studies Revisions of Pipe-Line Code

A joint committee of the American Gas Association and American Society of Mechanical Engineers met for the first time recently in Columbus, Ohio, to study possible changes in the code covering design, construction, operation, and maintenance of gas transmission and distribution pipe lines. Those attending the meeting, which included a 1,200-mile aerial tour of gas pipe lines in Ohio, West Virginia, Virginia, Pennsylvania, and Maryland, are (seated, left to right): Walter H. Davidson, general superintendent, Transcontinental Gas Pipe Line Corp., Houston; Chairman Frederick A. Hough, vice president of Southern Counties Gas Co. of California, Los Angeles; C. D. Alstadt, supervisory engineer of Columbia Gas System Service Corp., Columbus; and Norman F. Blundell, assistant chief engineer, Trunkline Gas Co., Houston. Standing: L. L. Elder, assistant senior pipe-line engineer, Columbia Gas System Service Corp., Columbus; M. M. Braidech, director of research, National Board of Fire Underwriters, New York; Carl T. Kallina, division of gas certificates, Federal Power Commission, Washington, D. C.; A. J. Shoup, engineer, Texas Eastern Transmission Corp., Shreveport; and B. T. Mast, Tennessee Gas Transmission Co., Houston.

Marion W. Boyer has resigned as general manager for the Atomic Energy Commission after 3 years' service and will return to the oil industry in which he was occupied prior to his government service.

F. M. Clingman, tool pusher for B.B.M. Drilling Co., has been transferred from Crane, Tex., to Midland, Tex.

Raymond W. Snyder has been named manager of Shell Oil Co.'s eastern exploration division with headquarters in Midland, Tex. He replaces **H. M. Goodman,** who has resigned, and will direct the company's exploration operations in the area extending from Midland to Fort Worth. Snyder joined Shell at Midland in 1947 as a subsurface geologist.

C. L. Perkins has been named general manager of El Paso Natural Gas Co., succeeding **C. C. Cragin,** also a vice president and with the company for 20 years. Cragin will continue as business and engineering consultant. Perkins joined El Paso 24 years ago and was superintendent of gas-treating and superintendent of the Permian division, transmission superintendent, and assistant general superintendent before being named vice president in 1944. **H. F. Steen,** associated with El Paso since 1929, has been elected vice president and general superintendent. He formerly was assistant general superintendent and had been superintendent of El Paso pipe-line district and transmission superintendent.

D. M. Simmons of Shreveport has been promoted to assistant general superintendent of production of Union Producing Co., production subsidiary of United Gas Corp. He fills the vacancy created by the recent promotion of **C. A. McDowell** to general superintendent of production. Simmons has been with Union and a predecessor firm since 1927 and was made assistant to the production superintendent in 1948. **B. J. Dowd** has been named assistant general superintendent of production engineering, and **Ben F. Carter** and **C. H. Clawson** have been made supervising production engineers for the firm's eastern and western divisions, respectively. Dowd, with United for 19 years, succeeds **T. W. Johnson,** who was recently named general superintendent of production engineering. He had been supervising production engineer since 1946. Clawson joined United in 1935, and has been production engineer at Shreveport since 1946. Carter joined the firm in 1934, and was a petroleum engineer in Louisiana and Texas before returning to Shreveport in 1945 as production engineer.

L. H. Dowell has been appointed assistant manager of administration of Phillips Petroleum Co.'s atomic-energy division at Idaho Falls, Idaho. **Langdon L. Leedy** has been appointed his staff assistant. Dowell previously was staff assistant to the vice president and general manager of Phillips Chemical Co. Leedy was assistant to the manager of Phillips Petroleum's foreign department, in charge of the office at Bartlesville, Okla.

John D. Gilboe of Los Angeles has been promoted by Shell Oil Co. from district geologist in the north San Joaquin district to division stratigrapher. He has been with Shell since 1925, working mainly in Long Beach, Los Angeles, and the San Joaquin Valley.

Dr. Ralph N. Lulek, formerly director and vice president of Heyden Chemical Corp., has joined Grace Chemical Co. as director and vice president of manufacturing and research.

Russell M. Brown, vice president of Bahrein Petroleum Co., Ltd., and for the last 7 years general manager of the company's operations in Bahrein in the Persian Gulf, has been transferred to New York as general manager of a newly created refining division of the Caltex organization. He has been succeeded as manager in Bahrein by **C. R. Barkhurst,** formerly superintendent of the Bahrein refinery.

C. I. Wall, president of West Texas Gas Co., has been elected a director of Amarillo Oil Co., succeeding **W. W. Rusk,** who had been chairman of the board and a director until his retirement recently.

Charles J. Eskridge, formerly district foreman at Andrews, Tex., has been transferred by Sinclair Oil & Gas Co. to Bairoil, Wyo. **Harold A. Lund** has been promoted from assistant district foreman to replace Eskridge. Other recent changes of Sinclair employes include **Charles W. Shawn,** assistant district foreman at Sedan, Kans., to Carmi, Ill.; **Cecil B. York,** roustabout at Nowata, Okla., to assistant district foreman at Sedan; **J. J. Wright,** assistant district foreman at Monument, N. M., to district foreman at Hobbs, N. M.; **Homer E. McIntire, Jr.,** intermediate petroleum engineer at Eldorado, Tex., to assistant district foreman at Monument; **Lindal G. Buchanan,** junior petroleum engineer at Homestead, Fla., to Opelousas, La.; **Chester R. Richards,** district foreman at Madison, Kans., to

PERSONALS

Thrall, Kans.; **P. B. Wolfe,** district foreman at Nowata to Madison; **A. E. Ward,** district foreman at Thrall to Nowata; **J. A. Robinson,** junior petroleum engineer at Nowata to Carmi; **Vernon R. Black,** gang pusher at Rankin, Tex., promoted to assistant district foreman; **Carl L. Keys,** assistant district foreman at Rankin to Lovington, N. M.; **William F. Burns,** district foreman at Midwest, Wyo., to Edmonton, Alta.; and **Bernard Weitzner,** junior petroleum engineer at Nowata to Gainesville, Tex.

Eugene Holman, president of Standard Oil Co. (N. J.), has been selected to receive the 1954 Captain Dollar Memorial Award of the National Foreign Trade Council for "distinguished contribution to the advancement of American trade." The presentation will be made at the fortieth National Foreign Trade Convention at the Waldorf-Astoria Hotel in New York November 16-18. He also will address the convention's world trade dinner.

Elmer H. Weaver, manager of purchases for Union Oil Co. of California since 1945, has been appointed assistant director for materials of the Office of Defense Mobilization.

Richard R. Young, recently graduated from Pennsylvania State College, has joined Ohio Oil Co. as a junior petroleum engineer in the production department at Hobbs, N. M.

Meade S. Eldred, consulting engineer, has transferred his offices from Fort Worth to San Antonio.

Arthur P. Allison, district geologist at Shreveport for Sun Oil Co., has retired after being with the firm 23½ years. He was district geologist at Houston from 1935 until being transferred to Shreveport in 1947.

J. P. Coleman, Wichita Falls, Tex., was reelected president of the National Stripper Well Association at its annual meeting held in conjunction with that of the Independent Producers Association of America in Fort Worth, October 19-20. Other officers reelected were **H. M. McClure,** Alma, Mich., and **Dave Scott,** Bradford, Pa., vice presidents; and **Fred Sehmann,** Wichita Falls, secretary-treasurer.

Leonard Raymond has been promoted to assistant chief automotive engineer of Socony-Vacuum Oil Co., Inc., in New York. He had been a staff engineer at Socony's research and development laboratories at Paulsboro, N. J.

John H. Wilson of Fort Worth and **Paul L. Lyons** of Tulsa have been nominated as candidates for president of the Society of Exploration Geophysicists for 1954-55. Wilson is exploration consultant and vice president of Piper Petroleum Co. and Woodson Oil Co., and Lyons is exploration manager of Anchor Petroleum Co. Other nominees for society offices are **Roy F. Bennett,** Houston, chief geophysicist for Sohio Petroleum Co., and **Ralph B. Ross,** Pittsburgh, supervisor of geophysical and structural geology of the geology division of Gulf Research & Development Co., for vice president; and **Richard Brewer,** Shreveport, district seismic supervisor for Atlantic Refining Co., and **Hugh M. Thralls,** Tulsa, vice president and director of Seismograph Service Corp., for secretary and treasurer. Results of the mail balloting will be announced shortly before the society's annual meeting next April.

Ross McCollum, president of National Oil Co., Los Angeles, has been elected vice president and to the board of directors of Basin Oil Co. of California, Los Angeles.

Jack H. Heathman, Wichita, and **Arthur A. Seeligson, Jr.,** San Antonio, have formed Heathman-Seeligson Drilling Co. The firm, which absorbed the personnel and operations of Heathman & Co., will operate mainly in Kansas.

Clifford L. Stockwell, junior petroleum engineer, has been granted a leave of absence by Stanolind Oil & Gas Co. to do graduate work in petroleum engineering at Pennsylvania State College. He had been at Elk Basin, Wyo.

D. N. Helmuth, geologist, has been transferred by Standard Oil Co. of California from Coalinga, Calif., to Oildale, Calif.

DEATHS

Porter Wesley Beck, 64, died recently at Bartlesville, Okla. He had been associated with Shell Oil Co. for 22 years before retiring in 1950. He earlier had worked for Kansas Natural Gas Co. for 9 years at Chanute, Kans., and also was with Tidal Gasoline Co. at Nowata, Okla., before joining Shell.

Carl Thim, 80, formerly with the research department of Standard Oil Co. of California, died recently in Los Angeles.

Herbert M. Coulson, 65, died October 16 in Tulsa following a heart attack. He retired September 1 as assistant general superintendent of Sinclair Oil & Gas Co.'s gas-products department. Coulson joined Sinclair in 1917 as superintendent of the firm's gas-products plant at Drumright, Okla.

J. Harry Lawson, 55, general manager of crude-oil purchasing for Atlantic Refining Co., died suddenly at his home in Philadelphia recently. He had been associated with Atlantic for 40 years.

Andrew Abegg, 71, partner in Abegg & Reinhold Co., oil-well tool manufacturers, died recently in Los Angeles.

George W. Deck, 57, died October 19 in Tulsa following a heart attack. He had been an independent operator for many years and moved to Tulsa from Okmulgee, Okla., in 1918.

Homer E. Britzman died recently at his home in Pasadena, Calif. He had been associated for several years with Richfield Oil Corp. and Rio Grande Oil Cos.

FREE REPRINTS OF "PETROCHEMICALS TODAY"

Because of the important reference value and educational services made available in this special article, The Oil and Gas Journal, P. O. Box 1260, Tulsa, Okla., will send you a reprint free on request. And write, Attention, Editorial Department, whether you liked this material . . . and how it is of value to you.

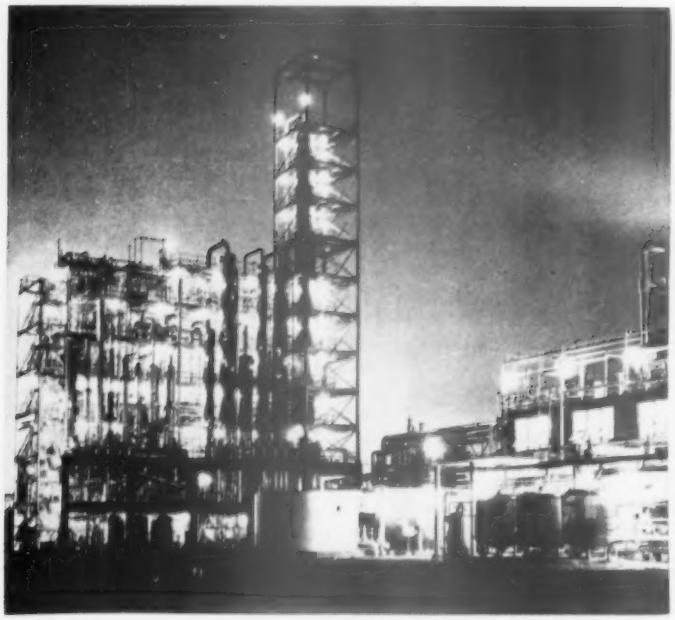
Petrochemicals Today . . .

What do you know about the North American petrochemical industry—

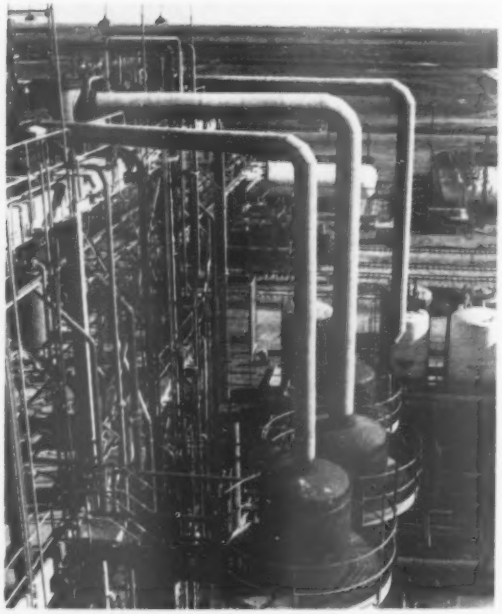
- How big is it?
- What products are made wholly or in part from petroleum or natural gas?
- How many oil companies are in the business?
- How many chemical companies make products derived from petroleum or natural gas?

. . . Here is the complete Journal survey

on petrochemical plants, with the answers to these questions and many others.

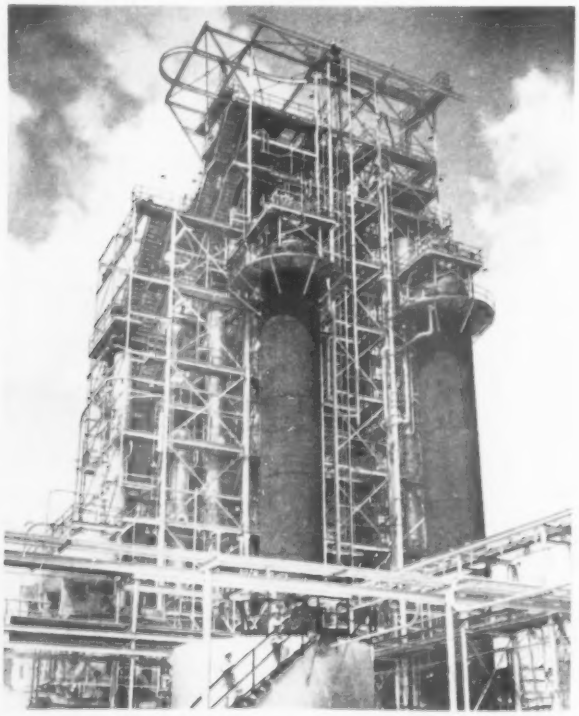


ETHANOL UNIT at the Longview, Tex., plant of Texas Eastman Co. Ethanol, butyraldehydes, and 2-ethylhexyl alcohol are synthesized from natural gas and L.P.G. In this unit ethylene, obtained by cracking propane, is combined with water to form ethanol.

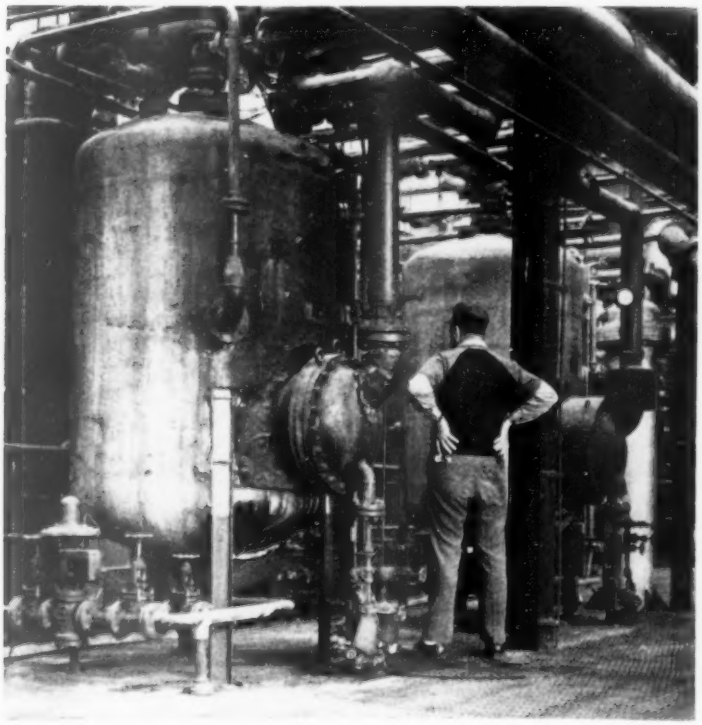


OVERHEAD LINES from distillation columns at the petrochemical plant of E. I. du Pont de Nemours & Co., Inc., 10 miles from Victoria, Tex. Natural gas and butadiene are used to make a nylon intermediate at the plant.

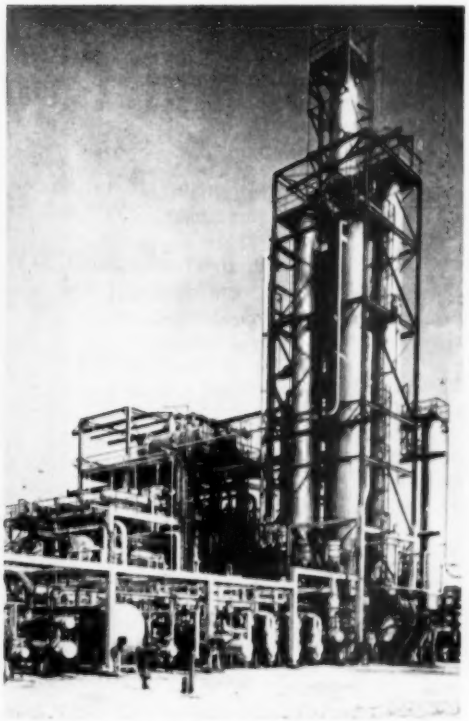
ETHYL ALCOHOL UNIT at the Shell Chemical Corp. plant, Houston. A number of petrochemicals are produced in the plant. Among the more important products are synthetic glycerin and a number of ethylene derivatives.



STYRENE MONOMER is purified in these distillation towers at the Texas City, Tex., plant of Monsanto Chemical Co. Raw materials for the production of styrene are propane and benzene. Other petrochemicals are also produced at the plant.

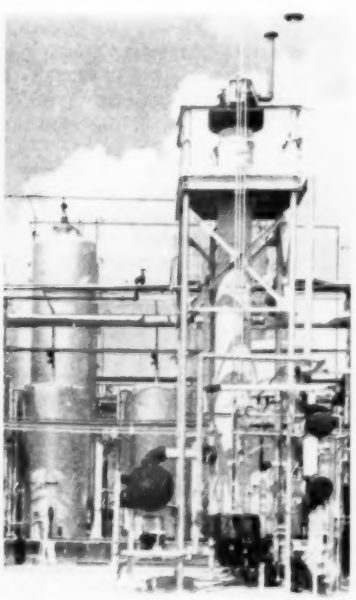


ONE OF THE FIRST petrochemical plants was established at South Charleston, W. Va., in 1925 by the forebears of Carbide & Carbon Chemicals Co. The plant produces most of the company's important aliphatic petroleum-derived intermediates. Ethanolamine reaction system is pictured here.

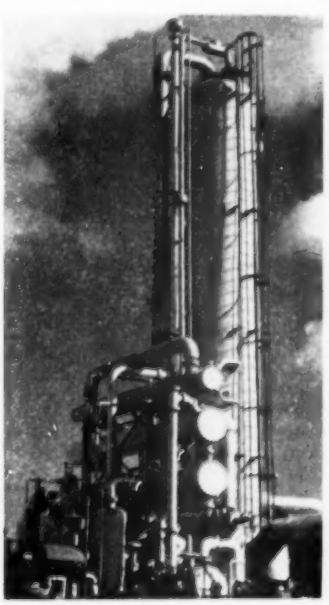


ETHYLENE UNIT of Jefferson Chemical Co., Port Neches, Tex., is shown here. Fractionating tower is at right, and condenser structure is at left. Refrigerated condensers are shown on top of structure.

BUTADIENE EXTRACTION unit at the Humble Oil & Refining Co., Baytown, Tex. Purified butadiene is then used in production of synthetic rubber. The rubber plant is located adjacent to the refinery properties.



ISOOCTYL ALCOHOL synthesis unit at the Baton Rouge, La., refinery of Esso Standard Oil Co. Capacity of the unit is 100 bbl. per day.



STRIPPING STILL at the Texas City plant of Carbide & Carbon Chemicals Co. is used to separate CO_2 from organic solvents.

U. S. and Canadian Petrochem Plants

- For the United States this survey lists 255 operating plants, including ammonia, sulfur conversion and carbon-black plants.
- The tables show 37 new plants or units definitely under construction or planned for construction, excluding carbon-black or sulfur conversion.
- A total of 138 companies is listed for both organic and inorganic petrochem operations.
- There are 35 oil companies engaged in organic petrochemical manufacture or raw-material supply.
- There are 51 chemical companies using petroleum derived feed stocks to make organic chemicals.

by John C. Reidel
Petrochemical Editor

IN MAKING THIS SURVEY . . .

MANY questions arise as to how many plants, how many companies and what products should be carried in following the growth of the burgeoning petrochemical industry.

The answers a survey like this brings up depend primarily on this:

1. Is the survey limited to the most basic steps with "primary" intermediates, does it include "secondary" intermediates, or does it include the end products as well?

2. How far back do we go in unraveling some of the really complex processing in which operations with petroleum and nonpetroleum feed stocks may overlap and interweave?

For example, consider Eastman Kodak Co. (Table 1). Texas Eastman Co. at Longview, Tex., definitely must be in our list—no argument there. Tennessee Eastman Co. at Kingsport, Tenn., poses a small problem — but again may be safely included. Now how about Eastman Kodak Co. at Rochester, N. Y.? At Rochester products from Kingsport go into photographic film and camera parts. Here judgment dictates that we call a halt, and this last step is omitted.

On the other hand, Chemstrand Corp. is listed as making nylon at Pensacola, Fla. We included this operation intact since it is the first wholly integrated nylon operation conducted at the one location.

Now look at the Carbide & Carbon Chemicals Co. products list at South Charleston, W. Va. Note that these products do not represent pilot-plant or trial batches. They are all commercial products. This one took some time and effort to unravel. Carbide & Carbon, a pioneer in petrochemicals manufacture, probably has the most diversified operations in the petrochemical industry.

Though possibly somewhat less diversified petrochemical-wise, the E. I. du Pont & Co. operations pose just about as tough a problem. We show relatively fewer petrochem products for du Pont because the company's operations could not be fully surveyed to make a satisfactory complete list at this time. Actually, it appears that du Pont probably makes some petrochemicals in virtually all of its same 71 plants!

• How Big?

For 1952 petrochemical raw materials went into some 21 billion pounds of chemical products, or about one-fifth of total U. S. chemical production. Total investment in petrochemical facilities has been variously estimated at between $2 billion and $3 billion.

Petroleum or natural gas feed stocks produced 17 billion pounds of organic chemicals. Some 70 per cent of the ethanol, 75 per cent of acetic acid, and 60-65 per cent of the ammonia produced in the United States are based on natural gas or petroleum. Natural gas serves as a base for perhaps 40 per cent of total petrochemical production.[1] (For additional statistical breakdown see the article by Bateman and Fie'd in this issue.)

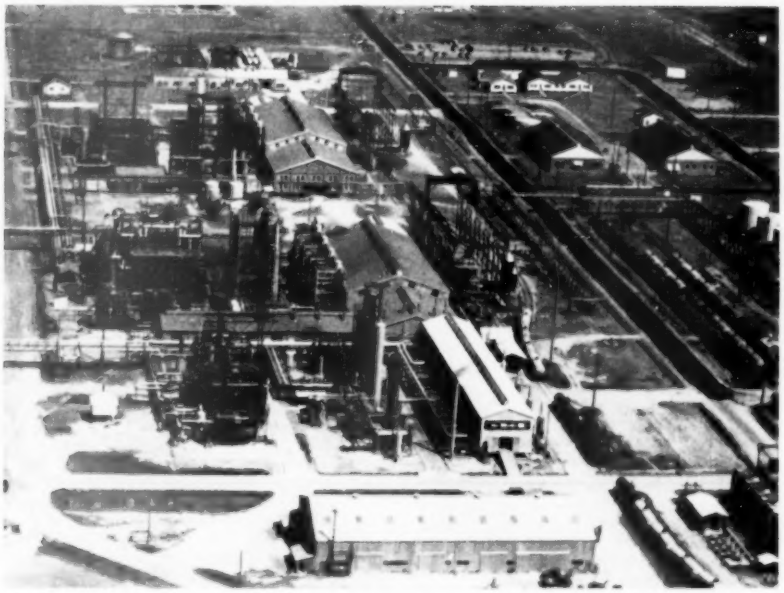
The fraction of total petroleum production going into chemicals is at present under 1 per cent. This is expected to rise to nearly 3 per cent by 1975 with a corresponding sixfold increase in production of petrochem intermediates.

Conversion of petroleum to motor fuel increases the value by two and one-half times on a volume basis. Conversion to chemical intermediates increases the value on the average by approximately 12 times.[2]

• Ethylene, No. 1 Feed Stock

From year to year ethylene shows up as the No. 1 or No. 2 petrochem feed stock. Production of ethylene in 1952 was 1,809 million pounds, according to the Tariff Commission report.[3] Potential increase in production of polyethene plastic, and increase in other uses, should tend to push upward the demand for ethylene.

Thermal cracking of light hydrocarbons (ethane, propane or mixtures of these), along with recovery from refinery cracked gases, constitutes the principal sources of ethylene in the



MORE PETROCHEMICALS—This aerial view of the newly expanded Sterlington, La., plant of Commercial Solvents Corp. shows expanded ammonia facilities, foreground, and methanol units in background. Production of these two basic petrochemicals from natural gas was doubled by the recent expansion program.

United States.[1] Cracking of naphtha to make ethylene is at present of greater importance in petrochem manufacture in England.[12]

Ethylene history was made with the installation of what may well be the world's largest ethylene cracking plant by Gulf Oil Corp. at Port Arthur, Tex. This plant began operation during the first quarter of 1953, with a rated capacity of about 2½ billion cubic feet annually. This represents an increase in total United States ethylene production of some 12 per cent. Gulf's ethylene pipe-line system is the first such designed for large volume distribution from a centrally located plant.

Chief sources of ethylene are in the southwest while main consuming markets for ethylene derivatives are located north and east. Plant location and transportation costs are therefore of primary importance in ethylene operations.

There is, of course, more than one way of solving the problem. Note the operation listed in Table I for the Koppers Co. which obtains ethylene feed stock from the Gulf ethylene plant. Benzene from eastern and southern coke ovens is shipped to Port Arthur by barge. The same barging system is employed to move ethylbenzene to the Koppers Kobuta, Pa., plant where it is made into styrene.[13]

• Acetylene, Large Potential

This material immediately comes to mind by virtue of its existing and potential competitive position with ethylene. It is known that acetylene is being manufactured commercially by partial combustion of natural gas (modified Sachsse process). This is essentially a short-time, high-temperature cracking process. A fairly complex solvent-recovery system is employed to separate the acetylene.

The Wulff process employs a regenerative furnace method. This process has undergone considerable testing and has recently been licensed to a number of engineering-contracting companies for design and erection of commercial plants.

• L.P.G. Feed Stock

Liquefied petroleum gas figures prominently as feed stock in the operations of the Celanese Corp. both at Bishop, Tex., and the new Pampa, Tex., plant. Liquefied propane and butane are also employed by Canadian Chemical Co., Ltd., a Celanese subsidiary, at Edmonton, Alta.[14]

A different example is provided by the Phillips Petroleum Co. superfractionator plant at Phillips, Tex.[15] Raw and deethanized liquids from widely scattered natural-gasoline plants in the Texas Panhandle and Permian basin are routed to this central fractionating plant. Present throughput of the Phillips superfractionator facilities is about 2,500,000 gal. daily.

Recently a possible trend may have been initiated toward installation of plants quite remotely located from the raw-material source.

One such installation is the 750,000 M.c.f.d. Tennessee Gas Transmission Co. low-temperature liquids-extraction plant at Greensburg, Ky. Here is a case of operation on lean pipe-line gas from which liquids may have already been stripped in Texas. This pipe-line gas goes through the wringer again at the T.G.T. plant to make over 300,000 gal. daily of L.P.G. of which about one-third is ethane.

Hydrocarbons so extracted are piped some 60 miles to the Doe Run plant of Mathieson Chemical Corp. at Brandenburg, Ky.

Another example is the Tuscola, Ill., plant of National Petrochemicals Corp. This plant is designed to process 425,000 M.c.f.d. of natural gas taken from the Panhandle Eastern Pipeline system. The plant is to take out 10,000,000 cu. ft. daily of ethane which is to be cracked to ethylene for production of ethyl alcohol and ethyl chloride.

The liquids-extraction section of the plant is now in operation.[17] The other facilities are under construction.

Acknowledgment

Sincere appreciation is expressed to the many chemical and oil companies who gave their best cooperation to make this survey possible.

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Table 1—U. S. Organic Petrochemical Plants

Company, location, and raw materials—	Principal products
Advance Solvents & Chemical Corp.,	
Jersey City, N. J.	
Petroleum naphthenic acid	Metallic naphthenates.
Alox Corp.,	
Niagara Falls, N. Y.	
Crude scale waxes; petrolatum, some distillate fuel oils	Oxygenated chemicals (for rust preventives), lube-oil additives, some special high-melting-point blending agents (for manufacture of carbon paper and floor polishes).
Allied Chemical & Dye Corp.,	
*Barrett Div., Frankfort, Pa.	
Propane-butane blend	Phenol and acetone.
National Aniline Div., Buffalo, N. Y.	
Kerosine fraction; white-oil fraction	Alkyl aryl sulfonates (water soluble); high-molecular-weight alkyl aryl sulfonates (oil soluble); dodecylbenzene.
*Nitrogen Div., Orange, Tex.	
Ethylene	Ethylene glycol and ethylene oxide.
South Point, Ohio	
Petroleum base stock	Petroleum sulfonate (sodium salt).
Natural gas	Ammonia, urea, ammonium nitrate, nitrate solutions, methanol, formaldehyde urea-formaldehyde concentrate.
*Solvay Process Div., Hopewell, Va.	
Petroleum base stock	Petroleum sulfonate (sodium salt).
Moundville, W. Va.	
Methane (natural gas)	Methyl chloride, methylene chloride, chloroform, carbon tetrachloride.
Hydrogen (derived from methane)	Hydrogen chloride.
Geddes, N. Y.	
Petroleum base stock	Petroleum sulfonate (sodium salt).
*Semet-Solvay Div., Buffalo	
Ethylene	High-melting-point polyethylene wax and long chain alcohol.
American Cyanamid Co.,	
*Avondale, La.	
Natural gas	Ammonia, acetylene, hydrocyanic acid, acrylonitrile, ammonium sulfate.
Warners, N. J.	
Petroleum fractions	Oil-layer type petroleum sulfonate (barium salt).
Atlantic Refining Co.,	
Philadelphia	
Crude petroleum fractions, refinery gases, and solvent extracts	Aromatic distillates and solvents, crude carbolates, sodium phenolate, crude cresylic acid, propane, butylenes, diisobutylene, technical eicosane, nonene, triisobutylene, crude mercaptans, alkylbenzene, nonyl dodecylbenzene, dodecylbenzenesulfonic acid type of water-soluble alkyl aryl sulfonates, sulfonated petroleum aromatic compounds including oil-layer type petroleum sulfonates (barium salt and sodium salt).
Philadelphia	
Asphalt	Thermoplastic resin.
†Philadelphia	
Detergent alkylate	Sulfonated detergents.
Atreco, Tex.	
Detergent alkylate	Sulfonated detergents.
Petroleum fraction	High-molecular-weight, polycyclic aromatic oil.
Atlas Processing Co.,	
Shreveport, La.	
Naphtha (400° F.e.p.) from natural-gas extraction	Benzene.
Bryton Chemical Corp.	
(See Continental Oil Co.)	
Brea Chemicals, Inc.	
(See Union Oil Co.)	
California-Spray Chemical Co.,	
Richmond, Calif.	
(Subs. Standard Oil Co. of Calif.)	
Petroleum bases	n-Trichloromethylthiotetrahydrophthalimide, n-butyl, 2,4-dichlorophenoxyacetate; isopropyl 2,4-dichlorophenoxyacetate; isopropyl 2,4-dichlorophenoxy-acetic acid (diethanolamine, isopropanolamine and triethanolamine salts); tetrahydrofurfuryl 2,4,5-trichlorophenoxy acetate; tetraethyl pyrophosphate (TEPP); ethylene glycol mono-oleate.
Carlisle Chemical Works, Inc.,	
Reading, Ohio	
Petroleum fraction	Additive (sulfur-chlorinated mineral oil component for cutting oils).
Carbide & Carbon Chemicals Co. (Div. of Union Carbide & Carbon Corp.)	
South Charleston, W. Va.	
Natural gas, refinery gases, crude oil, and other petroleum fractions	Acetaldehyde, acetaldol, acetic acid, acetic anhydride, acetoacetanilide, acetoacet-o-chloranilide, acetoacet-o-toluidide, acetonitrile, acetophenone, n-acetyl ethanolamine, allethrin, amines, aminoethyl morpholine, butadiene, butoxy ethoxy propanol, n-butyl acetate, n-butyl alcohol, n-butyl amine, n-butyl ethanolamine, n-butyl ether, butyraldehyde, butyric acid, butyric anhydride, caproic acid, hydroxyethyl cellulose, crotonaldehyde, dehydranone, diacetone alcohol, dibutoxy tetraglycol, dibutyl amine, dibutyl maleate, dichlorethyl ether, dichlorethyl formal, dichlorisopropyl ether, diethanolamine, diethoxy tetrahydrofuran, diethyl amine,

Company, location, and raw materials—	Principal products
	diethyl ethanolamine, n,n-diethyl ethylene diamine, diethyl ketone, diethyl maleate, 2,2-diethyl-1,3-propanediol, diethyl succinate, diethyl sulfate, diethylene glycol, di-2-ethylhexyl adipate, di (2-ethylhexyl) amine, di (2-ethylhexyl) maleate, diisobutyl carbinol, diisopropanolamine, diketene, dimethyl isopropanolamine, dioxane, dipropylene glycol, ethanol, 3-ethoxypropionaldehyde, ethoxytriglycol, ethyl acetate, ethyl acetoacetate, ethyl acrylate, ethyl amine, ethyl n-butyl ether, ethyl butyl ketone, n-ethyl ethanolamine, ethyl ether, ethyl-3-ethoxypropionate, ethyl formate, ethyl silicate, 2-ethyl 2-butyl propanediol-1,3, 2-ethylbutyraldehyde, 2-ethylbutyric acid, ethylene carbonate, ethylene chlorhydrin, ethylene dichloride, ethylene glycol, ethylene oxide, 2-ethylhexanediol-1,3, 2-ethylhexoic acid, 2-ethylhexyl acetate, 2-ethylhexyl amine, 2-ethylhexyl chloride, plasticizers, glycol diacetate, glycol diformate, glyoxal, heptadecanol, n-hexyl solvent, n-hexyl ether, hexylene glycol, isobutanol, isopropanol, isopropanolamine, isopropenyl acetate, isopropyl acetate, isopropyl amine, isopropyl ether, 2-mercaptoethanol, methanol, methoxy polyethylene glycols, methoxy triglycol acetate, methyl acetone, methyl amyl acetate, methyl amyl alcohol, n-methyl diethanolamine, methyl isobutyl ketone, n-methyl morpholine, monoethanolamine, monoisopropanolamine, morpholine, pentanedione-2,4, phenyl diethanolamine, phenyl ethanolamine, phenyl ethyl ethanolamine, phenyl methyl ethanolamine, n-phenyl morpholine, polyethylene glycols, polypropylene glycols, propionic anhydride, propylene chlorhydrin, propylene diamine, propylene dichloride, propylene glycol, propylene oxide, pyruvic aldehyde, surface-active agents, solvents, tetradecanol, tetraethanol ammonium hydroxide, thiodiglycol, trichlorethane, triethanolamine, triethyl amine, triethylene glycol, triglycol dichloride, triisopropanolamine, trimethyl cyclohexanol, trimethyl nonanol, synthetic lubricants, undecanol, vinyl isobutyl ether.
Institute, W. Va. Natural gas and other petroleum streams	Acetaldehyde, acetic acid, acetic anhydride, acetone, acetronitrile, acetophenone, acrolein, acrylonitrile, n-butyl alcohol, butyric acid, butyric anhydride, diethylene glycol, diisobutyl ketone, ethyl n-butyl ether, 2-ethylbutanol, ethylene glycol, ethylene oxide, 2-ethylhexonal, plasticizers, n-hexanol, isophorone, isopropanol, maleic anhydride, mesityl oxide, methyl acetone, 2-methyl-5-ethyl pyridine, methyl isobutyl ketone, paraldehyde, α-picoline, γ-picoline, polyethylene glycols, propionic anhydride, trimethyl nonanone-4.
Texas City, Tex. Refinery gases (ethane, propane)	Acetaldehyde, acetic acid, acetic anhydride, acetone, acetylene, 2-aminoethyl ethanolamine, butadiene, n-butyl acetate, n-butyl alcohol, diethylene glycol, diethylene triamine, ethanol, ethyl acetate, ethylene diamine, ethylene dichloride, ethylene glycol, ethylene oxide, isobutanol, isopropanol, isopropyl acetate, methanol, methyl acetone, methyl isobutyl ketone, tetraethylene pentamine, trichlorethane, triethylene tetramine, vinyl acetate, vinyl chloride, other vinyl resins and vinyl plastic materials.
*Texas City, Tex. Ethylene	Polyethylene.
Whiting, Ind. Refinery gases	Acetic anhydride, acetone, ethanol, ethylene glycol, ethylene oxide, isopropanol, methyl ethyl ketone, and methyl isobutyl ketone.
†Torrance, Calif. Refinery cracked gases (ethylene)	Polyethylene, ethylene glycol, and ethylene oxide.
*Seadrift, Tex. Natural gas (ethane)	Ethylene oxide, polyethylene.
Carthage Hydrocol, Inc.,‡ Brownsville, Tex. Synthesis gas (natural gas)	Acetaldehyde, propionaldehyde, n-butyraldehyde, methanol, ethanol, n-propanol, n-butanol, n-amyl alcohol, acetone, methyl ethyl ketone, methyl propyl ketone, acetic acid, propionic acid, butyric acid.
Celanese Corp. of America, Bishop, Tex. Natural gas (propane and butanes)	Propylene oxide, propylene glycol, dipropylene glycol, 1,3-butylene glycol, 2,3-butylene glycol, acetone, methanol, formaldehyde, paraformaldehyde, trioxane, acetaldehyde, acetic acid, isopropanol, n-propanol, isobutanol, prim-butyl, alcohols, special solvents, n-propionaldehyde, n-propyl acetate, pentaerythritol.
Pampa, Tex. Natural gas (propane and butanes)	Propionic acid, methylal, methanol, acetone, acetic acid, acetic anhydride, vinyl acetate, n-propyl acetate, n-butyl acetate, butyric acid.
Newark, N. J. Petroleum cryslic acid, petroleum derived phenol, dibutyl alcohol, dioctyl alcohol	Tricresyl phosphate, mixed esters, triphenyl phosphate, dibutyl phthalate, dioctyl phthalate.
Chase Chemical Corp., Pittsburgh, Pa. Petroleum naphthenic acid	Metallic naphthenates.
Chemstrand Corp. (Monsanto Chemical Co., and American Viscose Corp.) Decatur, Ala. Acrylonitrile	Acrylic fibers.
Pensacola, Fla. Petroleum base stocks	Nylon.
Cities Service Oil Co., Maud, Okla. Natural gas	Crude mixtures—methanol, acetaldehyde, formaldehyde, and acetone.
Oklahoma City Natural gas	Crude mixtures—methanol, acetaldehyde, formaldehyde, and acetone.
Tallant, Okla. Natural gas	Formaldehyde, paraformaldehyde, acetone, antifreeze chemicals, acetaldehyde, methyl-acetone type solvents—e.g., methyl acetone acetal, methanol.

Company, location, and raw materials—	Principal products
Lake Charles, La. (Govt. rubber plant)	
Petroleum feed stocks	1,3-Butadiene (grade for elastomers); 1-butene, 2-butene and mixtures.
Columbia-Southern Chemical Corp. (Subs. of Pittsburgh Plate Glass Corp.)	
Natrium, W. Va.	
Benzene	Chlorinated benzenes, benzene hexachloride.
Barberton, Ohio	
Propane	Perchloroethylene.
Commercial Solvents Corp.,	
Peoria, Ill.	
Natural-gas fractions	Nitro ethane, nitro methane, 1-nitro propane, 2-nitro propane, 2-nitro 1-butanol.
Sterlington, La.	
Natural gas	Ammonia, methanol, ammonium nitrate, nitric acid, nitrogen solutions.
Continental Oil Co.,	
Baltimore	
Propylene tetramer and benzene	Alkyl-aryl sulfonating stocks, including dodecylbenzene.
Chicago (Stepan Chem. Co.)	
Dodecylbenzene	Water-soluble surface-active sulfonates including liquid, slurried, drum-dried, and spray-dried stocks (dodecylbenzenesulfonic acid type).
Ponca City, Okla.	
Naphtha and propylene	Benzene, toluene, and propylene tetramer.
Trainer, Pa. (Bryton Chem. Corp.)	
Alkyl-aryl sulfonating feed stock	Oil-soluble surface-active sulfonates (lubricating-oil detergent additive, fuel-oil additives).
Westlake, La.	
Naphtha fraction	Benzene, toluene.
Propylene	Propylene tetramer.
Copolymer Corp.,	
Baton Rouge, La.	
(Government rubber plant)	
Petroleum base stocks	1,3-butadiene (grade for elastomers).
Cosden Petroleum Corp.,	
Big Spring, Tex.	
Naphtha fractions	Benzene, toluene, xylene.
Portions of doctor and caustic treating solutions	Ethyl, methyl and butyl mercaptans (odorants); cresylic acid; phenols.
*Big Spring, Tex. (Cosden Operator)	
Xylenes mixture	p-Xylene separation plant.
Crown Central Petroleum Corp.,	
Pasadena, Tex.	
Refinery gas stream	Ethylene and propylene (extracted by Shell Chemical Co.)
Diamond Alkali Co.,	
Pasadena, Tex.	
Ethylene	Perchlorethylene, vinyl chloride, and polyvinyl chloride.
Kolker Chemical Works	
Pasadena, Tex.	
Benzene	Benzene hexachloride, D.D.T., and Lindane.
Dow Chemical Co. (See also Ethyl-Dow Chemical Co.)	
Freeport, Tex.	
Natural gas (major feed stock) liquefied petroleum gases, and benzene	Ethylene and propylene; ethylene and propylene oxides; ethylene, propylene, diethylene, dipropylene, tetraethylene, triethylene, and tripropylene glycols; carbon tetrachloride; chloroform; dichloroethyl-dichloroisopropyl ether; styrene, ethyl-benzene; ethyl, methyl and methylene chlorides; vinyl and vinylidene chlorides; ethylene, ethylidene, and propylene dichlorides; methyl chloroform; perchlorethylene; styrene-butadiene latex.
Midland, Mich.	
Crude oil and natural gas	Ethylene, propylene, styrene, butadiene, 1,3-butadiene (grade for elastomers), butadiene-butylene mixtures, d-methyl styrene, ethylene glycol, ethyl benzene, ethyl chloride, ethylene dibromide, diethylbenzene, polystyrene, divinylbenzene, ethylene dichloride, dichloroethyl ether, ethylene oxide, mono-,di-,tri-ethanolamine, ethylene diamine, i-propylbenzene (cumene), i-propyl chloride, propylene oxide, i-propanolamines, vinyl chloride, toluene-2°, polyglycols, glycol ethers, styrene-butadiene latex, saran, polyvinyl chloride.
*Midland, Mich.	
Ethylene, toluene	Vinyltoluene.
Pittsburg, Calif.	
Natural gas	Methylene chloride, methyl chloride, chloroform, carbon tetrachloride, perchlorethylene.
Torrance, Calif. (Govt. rubber plant)	
Styrene Div.	
Petroleum base stocks	Benzene-100 per cent toluene-2°, ethylene, butadiene and butylene mixtures, heavy hydrocarbon mixtures and polymers, propylene, ethylbenzene, styrene.
*Torrance, Calif.	
Ethylene, benzene	Styrene, polystyrene.
E. I. du Pont de Nemours & Co., Inc.	
(List given here is considerably abbreviated; du Pont makes some petrochemicals in nearly all its plants)	
Orange, Tex.	
Ammonia, natural gas, propane, benzene, ethylene, cyclohexane, and adiponitrile	Methanol, ethylene, polyethylene, adipic acid, ethylene oxide, hexamethylenediamine, and nylon salts.
La Porte, Tex.	
Ammonia, methanol	Carbamate fungicides, methylamines, dimethyl foramide.

Company, location, and raw materials—	Principal products
Victoria, Tex.	
Natural gas, ammonia butadiene	Adiponitrile (nylon salt basics).
Memphis, Tenn.	
Natural gas	Hydrogen cyanide.
Carney's Point, N. J.	
Ethylene	Tetraethyllead.
Eastern States Chemical Corp.,	
Houston, Tex.	
Refinery streams	Butylenes (1-butene, 2-butene and mixtures, isobutylene), propane, n-butane, isobutane, isopentane.
(Eastern States Petroleum Co., Inc.)	
Naphtha fractions	Benzene-2 , mixed aromatics.
Eastman Kodak Co.,	
Rochester, N. Y.	
(See Tennessee Eastman and Texas Eastman)	
Enjay Co., Inc.,	
(See Esso Standard Oil Co.)	
Esso Standard Oil Co.,	
Baton Rouge, La.	
Refinery gas streams (ethylene, propylene, butylenes), petroleum fractions	Aromatic distillates and solvents; aromatic tars, ethane and ethylene, propane and propylene, 1,3-butadiene, grade for elastomers, butadiene-butylene mixtures, isobutylene, isoprene, dodecane, tripropylene, ethanol, isopropanol, isooctyl, alcohol, decyl alcohol, tridecyl alcohol, ethyl ether, isopropyl ether, dicyclopentadiene, benzene-2 , toluene, butyl rubber, tetrapropylene (dodecene), heptanes, naphthenes, acetone (from isopropyl alcohol).
Linden, N. J.	
Refinery streams	Naphthenic acids, diisobutylene (polyisobutylenes), isopropanol, sec-butanol, isopropyl acetate, sec-butyl acetate, methyl ethyl ketone, acetone, isopropyl ether, oil-layer-type petroleum sulfonates (sodium salt).
Ethyl-Dow Chemical Co., Inc.,	
Freeport, Tex.	
(See Dow Chemical Co.)	
Ethylene	Ethylene dibromide.
Ethyl Corp.,	
Baton Rouge, La.	
Ethane, ethylene, benzene (ethylene dibromide from Ethyl-Dow)	Tetraethyl lead, ethyl chloride, ethylene dichloride, technical benzene hexachloride, high-gamma benzene hexachloride, Lindane.
Pasadena, Tex.	
Ethylene (ethlnene dibromide from Ethyl-Dow)	Tetraethyl lead, ethyl chloride, ethylene dichloride.
Ferro Chem. Corp.,	
Mattawan, N. J.	
Petroleum naphthenic acid	Metallic naphthenates.
Firestone Plastics Co.,	
Pottsdam, Pa.	
(Firestone Tire & Rubber Co.)	
Petroleum base stocks	Polybutadiene-acrylonitrile-type (N type) acyclic elastomers; polybutadiene-styrene-type acyclic elastomers.
Food Machinery & Chemical Corp.	
(See Ohio-Apex, Inc., and Westvaco Chemical Div.)	
General Petroleum Corp.,	
Torrance, Calif.	
Refinery streams	Naphthenic acids, metallic naphthenates, sodium cresylate.
General Tire & Rubber Co.,	
Mogadore, Ohio	
Petroleum base stocks	Polybutadiene-styrene-vinylpyridine-type acydic elastomers.
Globe Oil & Refining Corp.,	
Lemont, Ill.	
Spent-caustic treating solution	Cresylic acids.
Goodyear Tire & Rubber Co.,	
Akron, Ohio	
(Chemical Products Div.)	Principal products
Petroleum base stocks	Polybutadiene-acrylonitrile-type (N type) acyclic elastomers, (rubbers and latices), high-styrene-type resins (point bases and rubber extenders).
B. F. Goodrich Chemical Co.,	
Avon Lake, Ohio	
Acetone	Ketone.
Formaldehyde	Propiolactone, acrylic acid.
Petroleum base stocks	Polybutadiene-acrylonitrile-type (n type) acyclic elastomers.
*Calvert City, Ky.	
Natural gas	Acrylonitrile.
Great Southern Chemical Corp.,	
(Pontiac Refining Co., The Chicago Corp., and La Gloria Corp.)	
Corpus Christi, Tex.	
Butane	Butylene concentrate.
*Corpus Christi, Tex.	
Naphtha fractions	Benzene, toluene, and xylene.

Company, location, and raw materials—	Principal products
Griffin Chemical Co.,	
Richmond, Calif.	
Petroleum fractions	Naphthenic acid, petroleum sulfonates (emulsifying agents).
Gulf Oil Corp.,	
Port Arthur, Tex.	
Refinery gases (ethane) other refinery streams	Ethylene, isooctyl alcohol, naphthenic acids, 1-butene, 2-butene and mixtures.
Harshaw Chemical Co.,	
Gloucester, N. J.	
Petroleum naphthenic acid	Metallic naphthenates.
Hercules Powder Co.,	
*Gibbstown, N. J.	
Propylene, benzene	Phenol, acetone, cumene, hydroperoxide.
Heresite Chemical Co.,	
Manitowoc, Wis.	
Petroleum products	Polybutadiene-acrylonitrile-type (N type) acyclic elastomers.
Heyden Chemical Corp.	
(See Monsanto Chemical Co.)	
Humble Oil & Refining Co.,	
Baytown, Tex.	
Refinery streams	Toluene-2°, xylenes (paraxylene separation), cyclohexane, petroleum sulfonates, high-boiling aromatic solvents, narrow-boiling range aliphatic solvents, special naphthas (hexane, heptane, octanes), cresylic acid. Petroleum phenols, 1,3-butadiene (grade for elastomers), 1-butane, 2-butene and mixtures, isobutylene, 2,2,4-trimethylpentane (isooctane).
Indoil Chemical Co.	
(See Standard Oil Co. of Indiana)	
Jefferson Chemical Co., Inc.,	
Port Neches, Tex.	
Refinery gases (ethane-ethylene and propane-propylene); propylene polymer and phenol	Ethylene oxide, ethylene glycol, diethylene glycol, ethylene dichloride, monoethanolamine, diethanolamine, triethanolamine, ethylene carbonate, propylene carbonate, morpholine, diethylethanolamine, hydroxyethyl morpholine, ethylene glycol ethers, diethylene glycol ethers, polyethylene glycols, triethylene glycol, nonyl and dinonyl phenols, ethylene oxide—nonyl phenol condensates, metallic phenolates, isooctyl alcohol.
Kendall Refining Co.,	
Bradford, Pa.	
Petroleum fractions	Heavy hydrocarbons (petroleum polymer and condensation resins).
Koppers Co., Inc. (Chemical Div.),	
Port Arthur, Tex.	
Ethylene	Ethylbenzene.
Kobuta, Pa.	
Ethylbenzene	Styrene.
Oil City, Pa.	
Petroleum fractions	Di-tert-butyl-para-cresol (oil additive and antioxidant), other alkylated phenols and cresols.
Lubrizol Corp.,	
Pasadena, Tex.	
Petroleum fractions	Petroleum sulfonates (barium and calcium salts) and other lube-oil additives.
Cleveland	
Petroleum fractions	Petroleum sulfonates (barium and calcium salts) and other lube-oil additives.
Mathieson Chemical Corp.,	
Brandenburg, Ky.	
Natural gas	Ethylene oxide, ethylene glycol, diethylene glycol, triethylene glycol, ethyl dichloride, and dichlorethyl ether, aromatic distillates and solvents.
Magnolia Petroleum Co.,	
Beaumont, Tex.	
Petroleum fractions	Cresylic acid, sodium cresylate solutions.
McGean Chemical Co.,	
Cleveland	
Petroleum naphthenic acid	Metallic naphthenates.
Merichem Co.,	
Greens Bayou, Tex.	
Refinery byproduct streams	Cresylic acid, sodium sulfide.
Monsanto Chemical Co.,	
Texas City, Tex.	
Natural gas (ethane and propane), refinery cracked gases, benzene	Ethylene, acetylene, ethylbenzene, styrene ethylene dichloride, vinyl chloride, acrylonitrile, hydrogen cyanide toluene-2° dodecylbenzene (including keryl-type benzenes).
St. Louis	
Petroleum feed streams	Phenol.
Petroleum cresylic acid	Tricresyl phosphate.
Texas City, Tex.	
Natural gas	Acetylene, ethylene.
Petroleum feed streams	Cumene, phenol and phenol derivatives, styrene, acrylonitrile.
*Texas City, Tex. (Heyden Chem. Corp., part owner)	
Byproduct hydrocarbons from acetylene synthesis	Methanol
*Avon, Calif.	
Benzene	Phenol.

Company, location, and raw materials—	Principal products
Montrose Chemical Co.,	
Newark, N. J.	
Petroleum cresylic acid	Tricresyl phosphate.
National Petrochemicals Corp. (National Distillers Products Corp. and Panhandle Eastern Pipeline),	
*Tuscola, Ill.	
Natural gas (ethane)	Ethylene, ethanol, ethyl ether and ethyl chloride.
Natural Gas Odorizing Co.,	
Houston, Tex.	
Petroleum fractions	Methyl, ethyl, higher mercaptans.
Neches Butane Products Co.,	
(Government owned rubber plant)	
Petroleum feed stocks	1,3-Butadiene (grade for elastomers).
Naugatuck Chemical Co.,	
(See U. S. Rubber Co.)	
Neville Co.,	
Neville Island, Pa.	
Unsaturated petroleum fractions	Aromatic petroleum solvents, oxidizing resins, and thermoplastic resins.
Anaheim, Calif.	
Unsaturated petroleum fractions	Aromatic petroleum solvents, oxidizing resins, and thermoplastic resins.
Oil & Chemical Products, Inc.,	
(See Refiner Processors, Ltd.)	
Ohio-Apex, (Subs. Food Machinery & Chemical Co.),	
Nitro, W. Va.	
Petroleum cresylic acid	Tricresyl phosphate.
Nuodex Products Co., Inc.,	
Elizabeth, N. J.	
Petroleum naphthenic acid	Metallic naphthenates.
Oronite Chemical Co. (See also Standard Oil Co. of Calif.)	
Oak Point, La.	
Petroleum base stocks	Lube-oil additives, furnace-oil additive.
Pan American Refining Corp.,	
Texas City, Tex.	
Petroleum base stocks	Benzene-2, toluene, xylenes, hydrocarbon resins (petroleum polymer and condensation resins), aromatic solvents, drying oils, alkylated naphthalene, nonene, dicyclopentadiene, propane, 1-butene, 2-butene, and mixtures.
Pan-Am Southern Corp. (Subs. Standard Oil Co. of Ind.)	
El Dorado, Ark.	
Refinery streams	Propylene tetramer, synthetic detergents, polybutenes.
Pennsylvania Industrial Chemical Corp.,	
Chester, Pa.	
Petroleum base stocks	Petroleum polymer and condensation resins.
Pennsylvania Refining Co.,	
Karns City, Pa.	
Petroleum base stocks	Oil-layer-type petroleum sulfonate (sodium salt).
Phillips Chemical Co. (Subs. Phillips Petroleum Co.)	
Pasadena, Tex.	
Ammonia, acetaldehyde	Methyl ethyl pyridine, methyl vinyl pyridine (5-vinyl 2-picoline).
Phillips, Tex. (Govt. owned rubber plants)	
Petroleum feed streams (n-butane)	1,3-Butadiene (grade for elastomers), 1-butene, 2-butene and mixtures, butadiene and butylene concentrates, methyl butenes.
Phillips Petroleum Co.,	
Phillips, Tex.	
Petroleum fractions	Aromatic distillates and solvents, cyclopentane, cyclohexane, methylcyclohexane, methylcyclopentane, methane, ethane and ethylene, propane and propylene, n-butane, isobutane, isopentane, n-pentane, 1-pentane and 2-pentane, diisopropyl (2,3-dimethylbutane), hexane, isohexane, neohexane, n-heptane, other heptanes, isoheptane, isoheptene, diisobutylene, 2,2,4-trimethylpentane (isooctane, other octanes), triisobutylene, neopentane, hexene, methylpentanes, methylpentenes, heptenes, n-octane, sec-butyl benzene, heavy hydrocarbons, tert-hexadecyl mercaptan, di-tert-butyl disulfide, di-tert-butyl polysulfide, tert-butyl mercaptan, alkyl mercaptans, mixed, methyl mercaptan, and dodecyl mercaptan.
Productol Co.,	
Santa Fe Springs, Calif.	
Refinery byproduct fractions	Phenols, cresols, cresylic acids.
Purex Corp., Ltd.,	
South Gate, Calif.	
Alkyl benzene	Petroleum detergents (sulfonated alkyl benzene).
St. Louis	
Alkyl benzene	Petroleum detergents (sulfonated alkyl benzene).
Pure Oil Co.,	
Smiths Bluff, Tex.	
Petroleum fractions; refinery gas streams	Petroleum polymer and condensation resins, solvents, nonparaffin concentrates, refinery gas stream (to Neches Butane Products Co.), 1-butene, 2-butene and mixtures.
Toledo	
Petroleum fractions	Solvents, toluene-2, xylene-aviation grade and heavy mixed aromatics and polymers.

Company, location, and raw materials—	Principal products
Cabin Creek, W. Va.	
Refinery gas streams (propane, n-butane)	Gas stream (to Carbide and Carbon Chemical Co., South Charleston).
Midland, Mich.	
Petroleum fractions	Solvents.
Refinery Processors, Ltd. and Oil Chemical Products, Inc.,	
Galena Park, Tex.	
Petroleum fractions	Benzene, toluene, xylene, aromatic solvent naphthas, odorless paint thinners, D.D.T. base.
Richfield Oil Corp.,	
Wilmington, Calif.	
Petroleum fractions	Naphthenic acids.
*Wilmington, Calif.	
Refinery cracked gases	Ethylene-ethane stream.
Reilly Tar & Chemical Corp.,	
Indianapolis, Ind.	
Petroleum fractions	Phenol, U.S.P.
Republic Oil Refining Co.,	
Texas City, Tex.	
Naphtha fraction	Benzene, toluene and xylene concentrates.
Refinery gas streams	Butane, butylene, propane, and ethylene.
Rohm & Haas Co.,	
Pasadena, Tex.	
Carbon monoxide, alcohols (acetylene is from carbide)	Acrylic monomers (methyl and ethyl acrylates).
Hydrogen cyanide (from natural gas and ammonia), acetone	Acetone cyanohydrin.
Philadelphia	
Petroleum base stocks	Oil-layer-type petroleum sulfonate (sodium salt).
Roosevelt Oil & Refining Co.,	
Mount Pleasant, Mich.	
Naphtha fraction	Benzene, toluene, and solvents.
Sharples Chemicals, Inc.,	
Wyandotte, Mich.	
Pentane, pentane fractions, triisobutylene	Amyl alcohol, amyl chloride, amyl acetate, amyl phenols, amyl naphthalenes, tertiary-dodecyl mercaptans, and tertiary dodecylthioether, 1-and-2-pentene and mixed pentenes.
Shell Chemical Co.,	
Houston (Deer Park), Tex.	
Petroleum base stocks	Acetone, diacetone alcohol, ethyl alcohol, hexylene glycol, isopropyl alcohol, isopropyl ether, mesityl oxide, methyl ethyl ketone, methyl isobutyl carbinol, methyl isobutyl ketone, secondary butyl alcohol, allyl alcohol, allyl chloride, epichlorohydrin, ethyl chloride, glycerin, diallyl phthalate, Epon resins (condensation polymers of epichlorohydrin and bisphenol), D-D soil fumigant (chlorinated C_3 hydrocarbons).
Dominguez, Calif.	
Petroleum fractions	Isopropyl alcohol, acetone, methyl ethyl ketone, other solvents and special products.
Martinez, Calif.	
Petroleum fractions	Isopropyl alcohol, acetone methyl ethyl ketone, other solvents. Inhibitors and additives for fuels and lubricants and other special products.
Denver, Colo.	
Petroleum fractions	Insecticides and agricultural chemicals.
*Norco, La.	
Propane and propylene	Allyl chloride and further derivatives.
Shell Oil Co.,	
Houston, Tex.	
Naphtha fractions	Benzene-2°, toluene-2°
Refinery streams	Propane and propylene, 1-butene, 2-butene and mixtures.
Martinez, Calif.	
Refinery streams	Cresylic acid, crude naphthenic acids, propane and propylene, 1-butene, 2-butene and mixtures, oil-layer-type petroleum sulfonate (sodium and calcium salts).
Wilmington, Calif.	
Petroleum streams	Xylene-3°, mixed xylenes, propane and propylene, 1-butene, 2-butene and mixtures, cyclohexane.
*Norco, La.	
Petroleum streams	Propane and propylene.
Shepherd Chemical Co.,	
Cincinnati, Ohio	
Petroleum naphthenic acid	Metallic naphthenates.
Sinclair Refining Co.,	
East Chicago, Ind.	
Petroleum fractions	Antioxidants, gear-oil additives, turbine-oil additives, and cutting-oil additives.
Sand Springs, Okla.	
Petroleum fractions	Demulsifying agents, corrosion inhibitors, acid-layer type petroleum sulfonate (sodium salt), and oil-layer type petroleum sulfonate (sodium salt).
Marcus Hook, Pa.	
Petroleum fractions	Dodecene, and cresylic acids.
*Marcus Hook, Pa.	
Petroleum fractions	Aromatic hydrocarbons (toluene, xylenes).
Houston	
Petroleum fractions	Oil-layer type petroleum sulfonates (barium, calcium and sodium salts), corrosion inhibitors, and isoparaffinic odorless solvents.

Company, location, and raw materials—	Principal products
Houston (Govt. owned rubber plant)	
Petroleum feed stocks	Butadiene.
Corpus Christi, Tex.	
Petroleum fractions	Aromatic solvents.
Wood River, Ill.	
Petroleum fractions	Aromatic solvents.
Wellsville, N. Y.	
Petroleum fractions	Petroleum resins.
Skelly Oil Co.,	
Eunice, N. M.	
Natural gas	Ethyl mercaptan and propyl mercaptan.
L. Sonneborn Sons, Inc.,	
Petrolia, Pa.	
Petroleum fractions	Oil-layer type petroleum sulfonate (sodium salt), water-soluble petroleum sulfonate.
Socony-Vacuum Oil Co., Inc.,	
Paulsboro, N. J.	
Petroleum fractions	Benzonitrile, thiophene, oil-layer type petroleum sulfonates, sodium cresylate solutions, sodium sulfide solutions (for paper manufacture).
Buffalo, N. Y.	
Petroleum fractions	Sodium sulfide solution.
Spencer Chemical Co.,	
Pittsburg, Kans.	
Natural gas	Methanol, ammonia, ammonium nitrate.
Calumet City, Ill.	
Methanol	Formaldehyde.
*Orange, Tex.	
Ethylene	Polyethylene.
Standard Oil Co. of California, (See also Oronite Chemical Co. and California-Spray Chemical Co.)	
Richmond, Calif.	
Petroleum base stocks	Ortho and para xylenes, alkyl aromatic detergents including dodecylbenzensulfonic type and dodecylbenzene including keryl benzenes, metallic naphthenates and naphthenic acids, non-ionic dispersants (alkyl phenyl poly glycol compositions), aliphatic acids, cresylic acids, acetone, petroleum sulfonates, polybutenes, gas odorants, phthalic anhydride, heavy hydrocarbons.
*Richmond, Calif.	
Cumene	Phenol, acetone.
El Segundo, Calif.	
Naphtha and other fractions, n-butane	Benzene, toluene, paraxylene, cumene butadiene-butylene mixtures, 1-butene, 2-butene and mixtures.
Standard Oil Co. (Ind.),	
Sugar Creek, Mo.	
Petroleum fractions	C₁₀ olefin concentrate.
*Wood River, Ill.	
Heptane heartcut from olefin feed and other petroleum refinery fractions	Isooctyl, nonyl, or higher alcohols.
Wood River, Ill.	
Petroleum fractions	High mol. wt. hydrocarbons (lube-oil detergents and petroleum plasticizers).
Whiting, Ind.	
Petroleum fractions	Benzene-2, solvent-grade toluene, xylenes (p-xylene separation) acid-layer type petroleum sulfonates, oil-layer type petroleum sulfonate, sodium carbolate, supplies refinery gases to carbide and carbon: Alkane-sulfonic acids, mixed; cresylic acid, refined; polybutanes; alcylic compounds, sulfurized; phosphorous derivatives of high mol. wt. hydrocarbons.
Stanolind Oil & Gas Co.,	
†Brownsville, Tex.	
Fischer-Tropsch synthesis products	Purified raw material from Carthage Hydrocol-acetaldehyde, acetic acid, acetones, n-propyl-carbinol, isopropylcarbinol, ethanol, isopropanol, methyl ethyl ketone (2-butane); propion-aldehyde, propionic acid, n-propanol.
Stauffer Chemical Co.,	
Louisville	
Propane	Carbon tetrachloride, perchloroethylene, and hydrogen chloride.
Stresen-Reuter, Frederick A., Inc.,	
Bensenville, Ill.	
Petroleum naphthenic acid	Metallic naphthenate.
Sun Oil Co.,	
Toledo	
Refinery streams	Propane, propylene, n-butane, n-butylene, i-butylene, propylene tetramer (dodecene), propylene trimer (nonene).
*Toledo	
Tail gas from cat reformer	Hydrogen (will be sold for iron reduction to Republic Steel Co.).
Marcus Hook, Pa.	
Refinery fractions	Oil-layer type petroleum sulfonates, naphthenic acids, propylene tetramer (dodecene), and propylene trimer (nonene).
*Marcus Hook, Pa.	
Naphtha fraction	Benzene, toluene, and xylenes.
Sun Chemical Corp.,	
(See Warwick Chemical Div.)	

Company, location, and raw materials—	Principal products
Sunray Oil Corp.,	
Duncan, Okla.	
Refinery gases	Propylene tetramer.
*Corpus Christi, Tex.	
Refinery gases	Propylene tetramer.
Texas Co., The,	
Port Arthur, Tex.	
Refinery fractions	Naphthenic acid, oil-layer type petroleum sulfonates ethane and ethylene; propane-propylene mixture; 1-butene, 2-butene, and mixtures; heavy hydrocarbons; dodecene (tetra propylene), nonene (tripropylene).
Tennessee Eastman Co. (Div. of Eastman Kodak Co.)	
Kingsport, Tenn.	
Ethanol, isobutyraldehyde, normal-butyraldehyde, isobutyl alcohol, and 2-ethylhexyl alcohol	Acetic and butyric acids and anhydrides, acetaldehyde, acetanilide, n-butyl acetate, croton-aldehyde, dibutyl phthalate, diethyl phthalate, di-(2-ethylhexyl) phthalate, diisobutyl phthalate, ethyl acetate, isobutyl acetate, isopropyl acetate, and triethyl phosphate.
Acetic and butyric acids and anhydrides	Cellulose esters (to acetate yarn and staple), acetate plastic, and acetate butyrate plastic.
Texas Eastman Co. (Div. of Eastman Kodak Co.)	
Longview, Tex.	
Propane and natural gas	Ethanol, isobutyraldehyde, butyraldehyde, isobutyl alcohol and 2-ethylhexyl alcohol; ethane and ethylene propylene; alkyl aromatics, distillate and solvents.
*Longview, Tex.	
Ethylene	Polyethylene.
Union Oil Co. of California,	
*Wilmington, Calif.	
Refinery streams	Methyl, ethyl mercaptans.
U. S. Rubber Co., (Naugatuck Chemical Div.),	
Naugatuck, Conn.	
Styrene, phthalic anhydride, maleic anhydride, ethylene glycol and other polyhydride alcohols and dibasic acids	Polyesters.
Butadiene and styrene	Rubber reinforcing resins, water-base paint latices.
Butadiene, acrylonitrile, styrene	Resin rubber mixtures for high impact plastics.
Baton Rouge, La.	
Butadiene and acrylonitrile	Polybutadiene-acrylonitrile-type (N type) acyclic elastomer.
Styrene, butadiene, acrylonitrile	Styrene-resin-nitrile rubber blends.
Universal Detergents, Inc.,	
Long Beach, Calif.	
Petroleum fractions	Alkyl aryl sulfonates.
Velsicol Corp.,	
Marshall, Ill.	
Petroleum base stocks	Benzene-2; benzene-motor grade; toluenes; xylenes; petroleum polymer and condensation resins.
Visco Products Co.,	
Sugarland, Tex.	
Petroleum fractions	Crude-oil desalting and dehydrating chemicals.
Warren Petroleum Corp.,	
†Houston, Tex.	
Liquefied petroleum gas (propane, butane)	Pentaerythitol, methanol, and acetaldehyde.
Westvaco Chemical Div. (Subs. Food Machinery & Chem. Corp.)	
Newark, Calif.	
Petroleum base stocks	Phenol.
South Charleston, W. Va.	
Petroleum base stocks	Phenol.
Warwick Chemical Div., (Sun Chemical Corp.),	
Rock Hill, S. C.	
Petroleum fractions	Oil-layer type petroleum sulfonate (sodium salt).
Witco Chemical Co.,	
Chicago	
Petroleum naphthenic acid	Metallic naphthenates (paint drying agents and lube additives).
Petroleum wax	Cracking inhibitors (rubber compounding).
Asphalt fractions	Rubber extenders, saturating compounds.
Perth Amboy, N. J.	
Solid petroleum tar; heavy-liquid and semisolid petroleum fractions	Rubber extender, extending plasticizer; rubber softeners.
Lawrenceville, Ill.	
Same as Perth Amboy plant	Same as Perth Amboy plant.
Wyandotte Chemicals Corp.,	
Wyandotte, Mich.	
Petroleum fractions	Alkyl aryl sulfonates, ethylene glycol, propylene glycol, ethylene dichloride, propylene dichloride chloroethers, aromatic distillation and solvents (chlorinated solvents).

*Under construction. †To be constructed. ‡Shut down.

TABLE 2—U. S. NITROGEN CHEMICALS MANUFACTURERS

Plant and location—

Allied Chemical & Dye Corp.,
South Point, Ohio
Ammonia, urea, ammonium nitrate, nitrate solution, methanol, formaldehyde, urea-formaldehyde concentrate.
*La Platte, Neb.
Ammonia, urea, nitrogen solutions.
Hopewell, Va.
Ammonia, urea, ammonium nitrate, nitrogen solutions including ammonium nitrate-ammonia and urea-ammonium nitrate-ammonia, sodium nitrate and nitrogen tetroxide.

American Cyanamid Co.,
Avondale, La.
Ammonia, ammonium sulfate.

Atlantic Refining Co.,
*Philadelphia
Hydrogen from catformer to ammonia.

Brea Chemicals, Inc. (Union Oil),
*Brea, Calif.

Commercial Solvents Corp.,
Sterlington, La.
Ammonium nitrate, nitric acid, nitrogen solutions.

Cooperative Farm Chemicals Corp.,
*Lawrence, Kans.
Ammonia, ammonium nitrate.

Deere & Co.,
*Pryor, Okla.
Urea and ammonia.

Delta Chemical Corp.,
*Pointe-a-la-Hache, La.

Grace Chemical Co. (W. R. Grace & Co.),
*Woodstock, Tenn.
Ammonia, urea.

Hercules Powder Co.,
Hercules, Calif.

Lion Oil Co.,
El Dorado, Ark.
*Luling, La.
Ammonia, ammonium nitrate.

Plant and location—

Mathieson Chemical Co.,
Lake Charles, La.
Ammonia, hydrazine.

Mississippi Chemical Corp.,
Yazoo City, Miss.

National Distiller's Products Corp.,
†Tuscola, Ill.
Hydrogen byproduct from National Petro-Chemical Corp., ethylene unit; will make ammonia, ammonium nitrate, nitrogen solutions.

Pennsylvania Salt Manufacturing Co.,
Wyandotte, Mich.

Phillips Chemical Co.,
Pasadena, Tex.
Ammonium sulfate.
Etter, Tex.
Ammonia, ammonium nitrate, nitrogen solutions.

Rocky Mountain Chemical Co.,
Billings, Mont.

San Jacinto Chemical Corp.,
Houston
Anhydrous ammonia.

Shell Chemical Co.,
*Ventura, Calif.
Operation October 1, 1953.
Pittsburg, Calif.
Martinez, Calif.
Dominguez, Calif.

Spencer Chemical Co.,
Pittsburg, Kans.
Ammonia, ammonium nitrate, methyl alcohol.
Henderson, Ky.
*Vicksburg, Miss.
Ammonia, ammonium nitrate, nitrogen solutions.

Union Oil Co.,
Wilmington, Calif.
Crystalline ammonium sulfate from waste ammonia vapor and refinery acid sludges.

*Under construction. †To be constructed

TABLE 3—UNITED STATES SULFUR CONVERSION PLANTS

From Sour Natural Gas

Plants and location—

Gulf Oil Co., Waddell, Tex.
Imperial Sulphur & Acid Co., Farmington, N. M.
Jefferson Lake Sulphur Co., Needville, Tex.
Mathieson Chemical Co., Stamps, Ark.
Odessa Natural Gasoline Co.-Sid Richardson, Odessa, Tex.
Phillips Chemical Co., Crane, Tex., Eunice, N. M., and Goldsmith, Tex.
Seaboard Oil Co., Silvertip, Wyo.
Stanolind Oil & Gas Co., North Cowden, Tex., Slaughter, Tex., Elk Basin Park, Wyo.
Sid Richardson Carbon Co., Keystone, Tex., Kermit, Tex.
Warren Petroleum Corp., Monument, N. M.

From Refinery Gases

Plants and location—

Allied Chemical & Dye Corp., El Segundo, Calif.
Atlantic Refining Co., Atreco, Tex., Philadelphia, Pa.
Cities Service Refining Corp., Lake Charles, La.

Plants and location—

Consolidated Chemical Industries, Inc., Baton Rouge, La.
*Consolidated Chemical Industries, Inc., Baytown, Tex.
Davison Chemical Co., Baltimore, Md., and Linden, N. J.
Esso Standard Oil Co., Linden, N. J.
Freeport Sulphur Co., Westville, N. J.
Globe Oil & Refining Co., Lemont, Ill.
Gulf Refining Co., Port Arthur, Tex.
Hancock Chemical Co. (Hancock Oil Co. of Calif.) Watson, Calif. (foul ammonia solution).
Shamrock Oil & Gas Corp., Sunray, Tex.
Shell Chemical Co., Houston, Tex.
Sinclair Refining Co., Marcus Hook, Pa.
Standard Oil Co. (Ind.), Whiting, Ind.
Stauffer Chemical Co., Dominguez, Calif. (Hydrogen sulfide and refinery acid sludge to sulfuric acid.)
The Texas Co., Port Arthur, Tex.
Union Oil Co., Wilmington, Calif.
Texas Gulf Sulfur Co., Worland, Wyo. (Pure Oil Co. furnishes acid gas stream).

*Under construction.

TABLE 4—UNITED STATES BUTADIENE PLANTS

(From Petroleum)

Government Owned

Plants and locations—

Cities Service Refining Co., Lake Charles, La.
Copolymer Corp., Baton Rouge, La.
Humble Oil & Refining Co., Baytown, Tex.
Neches Butane Products Co., Port Arthur, Tex.
Phillips Chemical Co., Borger, Tex.
Shell Chemical Corp., Torrance, Calif.
Standard Oil Co. of California, El Segundo, Calif.
Sinclair Rubber, Inc., Houston.

Privately Owned

Plants and locations—

Carbide & Carbon, South Charleston, W. Va., Texas City, Tex.
Dow Chemical Co., Midland, Mich.
Esso Standard Oil Co., Baton Rouge, La.

TABLE 5—UNITED STATES CARBON-BLACK PLANTS

Furnace Process

Plant and location—

Cabot Carbon Co., Guymon, Okla., Ville Platte, La.
Carbon Corp. of America, Bishop, Tex.
Columbian Carbon Co., Conroe, Tex., Eola, La., Fairbanks, Tex., Fortune, Tex., Hickok, Kans., Seagraves, Tex.
Continental Oil Black Co., Westlake, La.
Continental Carbon Co., Sunray, Tex., Eunice, N. M.
General Atlas Carbon Co., Pampa, Tex., Big Spring, Tex.
J. M. Huber Corp., Baytown, Tex., Borger, Tex.
Phillips Chemical Co., Borger, Tex.
Shell Chemical Corp., Pittsburg, Calif.
Southern Carbon Co., Hancock, La.
Thermatomic Carbon Co., Sterlington, La.
United Carbon Co., Inc., Aransas Pass, Tex., Shamrock, Tex., Ryus, Kans.

Channel Process

Plant and location—

Barnhart Hydrocarbon Corp., Big Lake, Tex.
Cabot Carbon Co., Skellytown, Tex., Pampa, Tex., Monahans, Tex., Kermit, Tex., Hobbs, N. M.
Carbon Blacks, Inc., Rayville, La.
Coltex Corp., Lefors, Tex.
Columbian Carbon Co., Kingsmill, Tex., Corpus Christi, Tex., Seagraves, Tex., Sunray, Tex., Eunice, N. M.
Combined Carbon Co., Sanford, Tex.
Continental Carbon Co., Eunice, N. M., Sunray, Tex.
Crown Carbon Co., Sunray, Tex.
J. M. Huber Corp., Borger, Tex.
Peerless Carbon Black Co., Ulysses, Kans., Pampa, Tex.
Sid Richardson Carbon Co., Odessa, Tex.
Texas Elf Carbon Co., Pampa, Tex.
United Carbon Co., Inc., Aransas Pass, Tex., Borger, Tex., Falfurrias, Tex., Rayville, La., Sanford, Tex., Stinnett, Tex., Sunray, Tex., Swartz, La.
Witco Carbon Co., Eunice, N. M.

Roller Process

Plant and location—

Peerless Carbon Black Co., Sweeny, Tex.

TABLE 6—CANADIAN PETROCHEMICAL PLANTS

Company, location, and material—	Principal products
B. A. Shawinigan, Ltd., Montreal, Que.	
Propylene and benzene	Phenol plus acetone (byproducts—acetophenone, mesityl oxide, and alpha methyl styrene)
Bakelite (Canada), Ltd., Belleville, Ont.	
(Carbide & Carbon Chemical Co. affiliate)	
Methanol	Formaldehyde (for phenol-formaldehyde and urea-formaldehyde plastics)
Cabot Carbon of Canada, Ltd., Sarnia, Ont.	
Petroleum fractions	Oil-type furnace black
Canadian Chemical Co., Ltd., *Edmonton, Alta.	
(Subsidiary of Celanese Chemical Corp.)	
Butane and propane (refinery streams)	Pentaerythritol, methanol, propylene glycol, dipropylene glycol, n-propanol, n-propyl acetate, acetic acid, acetone, other alcohols, glycols, aldehydes, oxides, ketones, and cellulose acetates
Canadian Industries, Ltd., *Edmonton, Alta.	
Ethylene (by cracking natural gas)	Polyethylene
*Maitland, Ont.	
Cyclohexane (imported base stock)	Adipic acid and hexamethylenediamine (nylon salts intermediates)
*Calgary, Alta.	
Natural gas	Ammonia
Canadian Oil Co., Ltd., Sarnia, Ont.	
Refinery streams	Butylene
Consolidated Mining & Smelting Co., Turner Siding, Calgary, Alta.	
Natural gas	Ammonia and ammonia nitrate
Dominion Tar & Chemical Co., Montreal, Que.	
Refinery gases (ethane and ethylene)	Ethylene oxide, ethylene glycol, higher glycols, and detergents
Dow Chemical Co., Sarnia, Ont.	
Refinery gases	Ethylene oxide, ethylene glycol, ethyl chloride, methyl and methylene chloride, styrene and polystyrene
Dow Chemical Co.,* Sarnia, Ont.	
Styrene	Polystyrene
Imperial Oil, Ltd., Sarnia, Ont.	
Refinery gases	Methane, ethane, ethylene, propane, propylene, and butylene
Lubrizol of Canada, Ltd., Niagara Falls, Ont.	
Petroleum fractions	Lube-oil additives
Monsanto Canada, Ltd., Montreal, Que.	
Petroleum base stock	Polystyrene
Polymer Corp., Sarnia, Ont.	
Refinery streams	Styrene, copolymer and butyl rubbers, ethylene, isobutylene
Royalite Oil Co., Turner Valley, Alta.	
H_2S from natural gas	Sulfur
S. Nord Chemical Co., Petrolia, Ont.	
Cat reformate	Benzene, toluene, xylene
St. Maurice Chemicals, Varennes, Que.	
(Shawinigan and Heyden)	
Refinery gases, methanol, and acetaldehyde	Formaldehyde and pentaerythritol
Shell Oil Co. of Canada, Ltd., Jumping Pond, Alta.	
Sour natural gas	Sulfur
Montreal, Que.	
Propane-propylene	Isopropyl alcohol and acetone
Sherritt-Gordon Mines, Fort Saskatchewan, Alta.	
Natural gas	Ammonia
Sun Oil Co., *Sarnia, Ont.	
Refinery streams	Propane, propylene, n-butane, isobutane, and n-butylene
Vosco Industrial Chemical Products, Ltd., Montreal, Que.	
Petroleum fractions	Dodecyl, benzene and higher alcohols converted to synthetic detergents

*Under construction.

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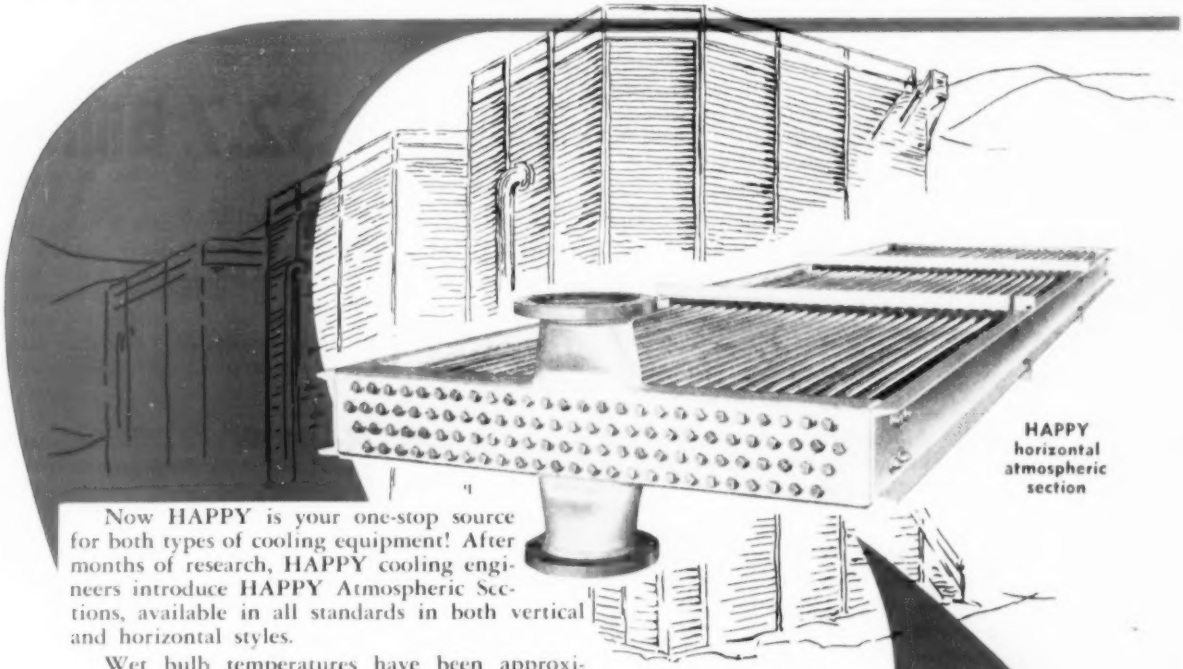

HAPPY horizontal atmospheric section

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Wet bulb temperatures have been approximated, as closely as possible, by achieving uninterrupted flow of fluid through the section and water over the section. Trouble-causing back pressures have been eliminated by providing ample flow area in HAPPY Open-Flow nozzles.

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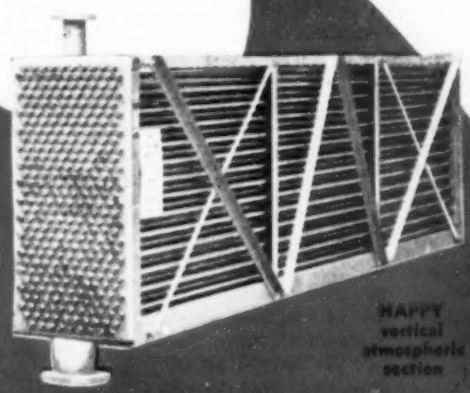
There are no replacement problems with HAPPY atmospheric sections. HAPPY-built heads and tubes can also be used as replacement sections for other makes.

Quick delivery can be made on every order. Be sure to call your nearest HAPPY office the next time you need FIN-TYPE *or* ATMOSPHERIC cooling equipment.



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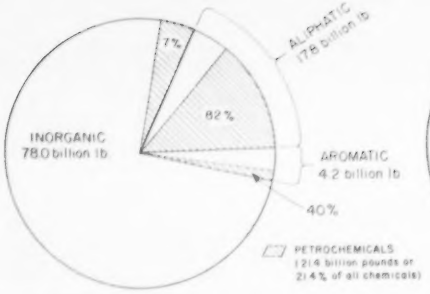
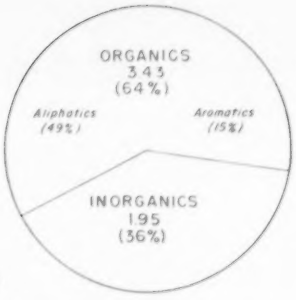
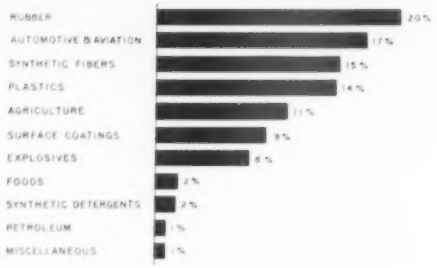


U. S. PRODUCTION of chemicals in 1952. Total was 100.4 billion lb. Fig. 1.



VALUE OF CHEMICALS produced in U. S. in 1952. Fig. 2.



PETROCHEMICAL END USES—1952 percentage breakdown on a tonnage basis.

1952 Petrochemicals Valued at $2.7 Billion

This figure is exactly half of the value of $5.4 billion for total U. S. chemical production for that year. Volumewise, petrochemical production amounted to 21.4 billion pounds, or 21 per cent of the total chemical production figure of 100.4 billion pounds.

by R. L. Bateman* and J. A. Field†

FOR the year 1952 petrochemicals comprised 21 per cent of the United States chemical production. This amounted to 21.4 billion pounds of the entire production of 100.4 billion pounds. (See Fig. 1.) The value of petrochemicals was 2.7 billion dollars out of a total of 5.4 billion dollars.

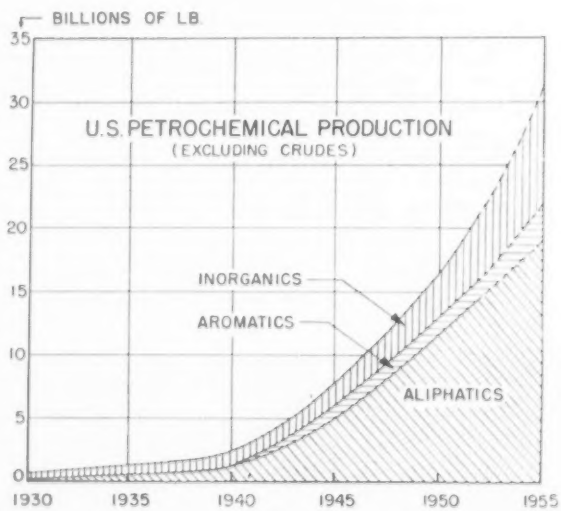
The petrochemical portion is made up of 2.2 billion dollars of aliphatics, 300 million dollars of aromatics, and 200 million dollars of petrochemical inorganics. The average sale price per pound of the aliphatics was 15 cents; of aromatics, 19 cents; and of the inorganics, 2.5 cents. Total 1952 assets of the petrochemical industry is 2.5 billion dollars were about 52 per cent of the entire chemical industry. (See Figs. 2 and 3.)

Aliphatic petrochemicals . . . The most important of the petrochemicals are the aliphatics. The 14.3 billion pounds of aliphatic petrochemicals were produced in 1952—82 per cent of all aliphatics. The aliphatics are derived mainly from C_1 to C_4 hydrocarbons. However, not all aliphatics come from petroleum or natural-gas sources. About 18 per cent of the aliphatics are derived from coal and agricultural products. Chloroprene made from calcium carbide for neoprene rubber and glycerol from fats and oils are examples of aliphatics of "nonpetrochemical" origin.

The aromatic petrochemicals consist primarily of the "crudes"—benzene, toluene, and xylene from which are derived the "intermediates"—phenol, stryene, and aniline. The aromatics are comparatively recent additions to the petrochemical family and were first produced about 1940 by Humble Oil & Refining Co. and Shell Chemical Co.

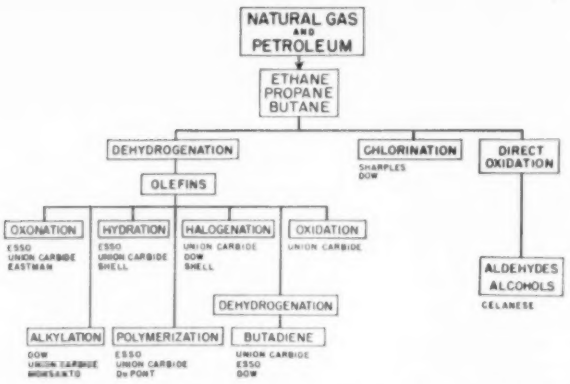
The 4.2 billion pounds of all aromatic intermediates includes the production of phenol, styrene, aniline, and all other aromatic intermediates—as reported by the Tariff Commission. About 40 per cent of the "aromatic crudes" are of petrochemical origin. Hence, the assumption follows that a similar percentage of the "intermediates" (phenol, styrene, aniline, etc.) are also petrochemically derived. The aromatic petrochemicals then total 1.7 billion pounds out of the 4.2 billion pounds of all aromatics.

Inorganic petrochemicals . . . Inorganic petrochemicals are largely associated with or derived from natural gas. They are ammonia, carbon black, and sulfur. About 5.4 billion pounds or 7 per cent of all inorganic chemicals (78 billion pounds) produced in 1952 were petrochemicals. It is estimated that 1.2 million tons of ammonia out of a total of 2.05 million tons as reported by the



U. S. PETROCHEMICAL PRODUCTION by years, 1930 through projected figures for 1955. Figures exclude crude products. Fig. 3.

*Manager and †assistant manager, fine chemicals department, Carbide & Carbon Chemicals Co. (a division of Union Carbide & Carbon Corp.). Paper presented at the symposium on Petrochemicals in the Postwar Years; sponsored by the Petroleum Division, American Chemical Society; held in Chicago, September 6-11, 1953.



BASIC PETROCHEMICAL PROCESSES are shown in schematic form in this outline. Fig. 4.

Bureau of Census were derived from natural gas. Practically all carbon black (1.8 billion pounds) was obtained by combustion of natural gas or petroleum. An estimated 5 per cent of the total sulfur of 6.36 million long tons was recovered from natural gas or petroleum.

Petrochemical Processes

Figs. 4 through 7 present important basic processes out of which the petrochemical industry has mushroomed. Fig. 4 traces several steps beyond the basic raw materials ethane, propane, butane, and petroleum. The cracking of these heavier components of natural gas or the cracking of petroleum or petroleum fractions results in the formation of olefins. These olefins were first utilized in the hydration of propylene to isopropanol by Esso Standard Oil Co. This hydration process like that employed by Union Carbide & Carbon Chemicals Co. for ethanol depends upon the absorption of the olefins in sulfuric acid, with subsequent hydrolysis to the alcohol. The next significant advance in the hydration of olefins occurred 25 years later when Shell pioneered the direct hydration of ethylene.

Early in the twenties Union Carbide began the halogenation of ethylene to produce ethylene dichloride and hypohalogenation to produce ethylene chlorhydrin, an intermediate for ethylene oxide and ethylene glycol. Shell's chlorination of olefins is a different type, namely the hot chlorination of propylene. This process is one of the first steps in the synthesis of glycerol, accomplished commercially in the postwar period. The direct oxidation of ethylene became a commercial reality when Union Carbide undertook this alternate route to ethylene oxide about 1937.

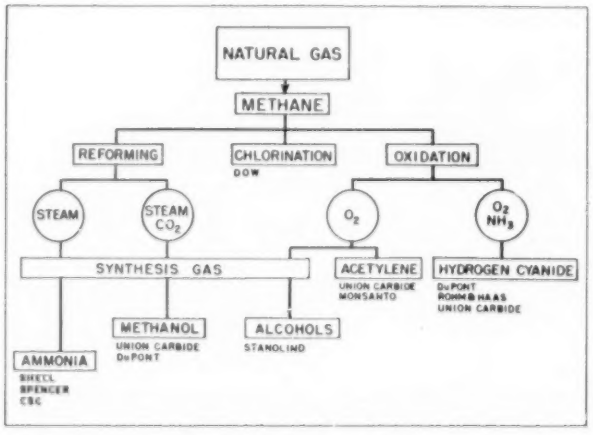
The synthetic rubber program in the late thirties provided the impetus for large scale alkylations of benzene with olefins for the synthesis of ethyl benzene prior to dehydrogenation to styrene. Probably the first polymerization of olefins was Esso's polyisobutylene around 1940, followed shortly thereafter by Union Carbide's and du Pont's polyethylene. Dehydrogenation of olefins is now the principal method of synthesis of butadiene. The most recent commercial process utilizing olefins is in Oxonation, which was originally developed in Germany and first put into operation at Baton Rouge by Esso in the postwar period. Subsequently Union Carbide and Texas Eastman employed the same synthesis for aliphatic chemicals and Standard Oil Co. of Indiana and Gulf Oil expect to have commercial plants in operation in 1953.

In a few cases, the hydrocarbons are attached directly without prior dehydrogenation to olefins. In the mid-twenties Sharples Chemical Co. began the direct chlorination of pentane for the synthesis of amyl compounds.

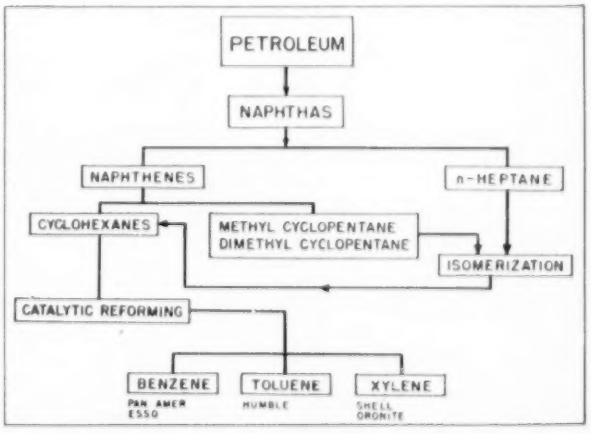
The Celanese Corp. during the last decade has developed a process by which propane and butane are oxidized directly to aldehydes, ketones, and alcohols, which are ultimately converted to other important aliphatic chemicals, such as acetic acid, acetic anhydride, n-butyl alcohol and propylene glycol.

Postwar period . . . Possibly the most significant expansion of petrochemical processes in the postwar period has been in the use of methane (see Fig. 5). Methane from natural gas has almost entirely supplanted coal in the manufacture of synthesis gas—carbon monoxide and hydrogen. Synthesis gas has long been a source of methanol but it was not obtained from methane until Union Carbide commenced production of petrochemical methanol in the early 1940's. Du Pont in transferring its methanol operations to Texas about 1948 continued the expansion of the petrochemical processes for methanol.

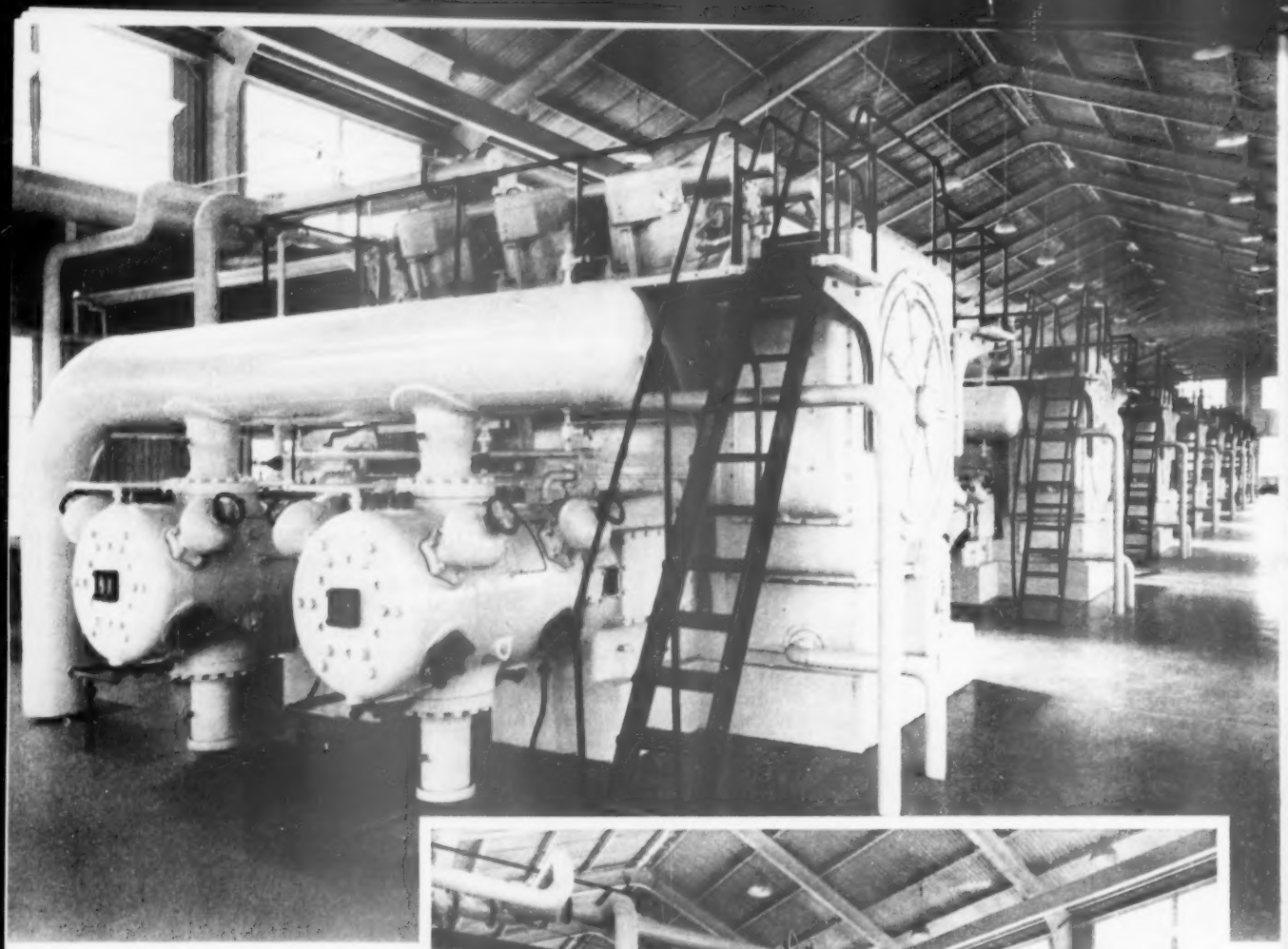
In the postwar period methane has also become the largest source of hydrogen for the synthesis of ammonia.



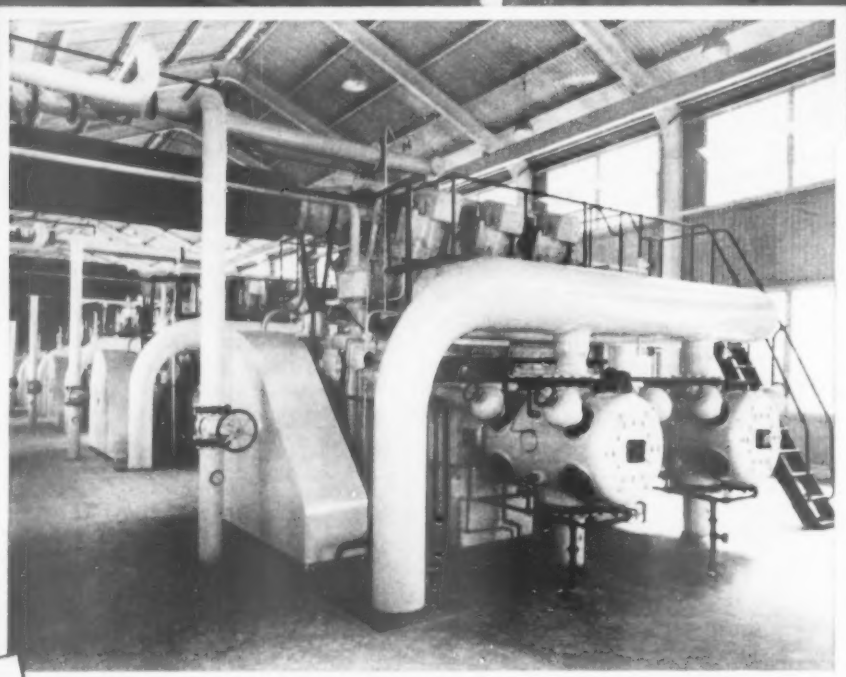
USE OF METHANE for feedstock in petrochemical processes has increased sharply in the postwar period. Fig. 5.



SUITABLE NAPHTHA CUTS from the refining of cracked stocks are sources of aliphatics, naphthenes, and aromatics. Fig. 6.



Line-up of Cooper-Bessemer GMW V-angles on United Gas Pipe Line Company's two largest compressor stations, the Edna No. 2 (top) and Refugio stations. Each station has eight 1500 hp GMW-6's totaling 12,000 horsepower per station. With separate jacket water pumps and magneto ignition systems, these modern V-angles can operate independently and are further equipped with automatic shutdown controls.



Main compressor building of the new 12,000 hp Cooper-Bessemer powered Edna No., 2 station — part of the huge expansion that makes the United Gas system the world's largest.

ANGLE V

Compressors

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San Francisco, Cal. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash.

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Cooper-Bessemer GMW compressors, totaling 34,000 horsepower of additional capacity, were installed by United Gas Pipe Line Company during its multi-million dollar expansion program started in 1951 and completed this year.

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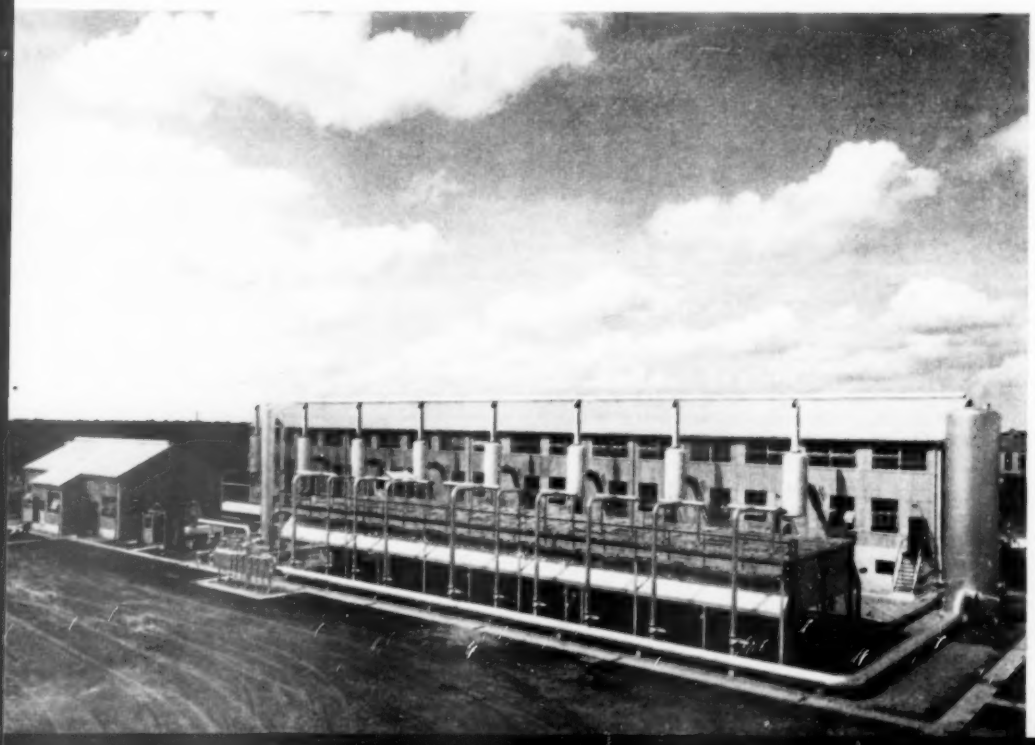
Throughout the South and throughout the world — wherever top performance is demanded — you will find smooth-working, compact Cooper-Bessemer units. If you are searching for efficient compressors offering increased profits and reduced operating costs, check with your nearest Cooper-Bessemer office.



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MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

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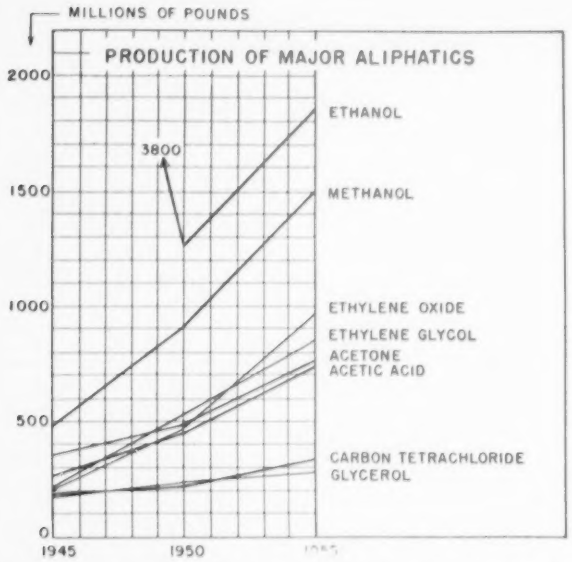

GROWTH OF ALIPHATIC chemical production in the period 1945 through 1955 (projected) is shown by this chart. Fig. 7.

The first petrochemical ammonia was made by Shell around 1931. However, the original process employed the cracking of methane as a source of hydrogen rather than today's preferred route via synthesis gas. By a somewhat different pattern, via a modified Fischer-Tropsch reaction, Carthage Hydrocol at Brownsville, Tex., has been producing a variety of oxygenated compounds that were marketed through Stanolind and U.S.I.

The partial oxidation of methane to produce acetylene was accomplished on a commercial scale by Union Carbide at Texas City in 1950. Subsequently, Monsanto placed a similar plant in operation to provide acetylene for their acrylonitrile operations. In the 1930's du Pont developed a process for the synthesis of hydrogen cyanide based upon the oxidation of methane in the presence of ammonia. Rohm & Haas, Union Carbide and Monsanto have constructed large scale commercial units employing this process in the postwar period.

Refinery gases . . . The cracking of petroleum has long been a source of byproduct olefins. In addition, suitable cuts in the refining of the "cracked stocks" gives naphthas from which can be separated the naphthenes (cycloparaffins) as well as the aliphatics of which heptane is an example. By suitable refining methods, the cyclohexanes and substituted cyclopentanes can be separated from the heptanes. The substituted cyclopentanes are isomerized to the cyclohexanes. Then, either by catalytic reforming or platforming, the cyclohexanes are converted to such aromatics as benzene, toluene, and xylene. In this general field the petroleum companies, including Pan American, Esso, Humble, Shell and Oronite, have been the most active. Fig. 6 shows these processes.

There is also some indication that materials such as heptane, by suitable cracking and isomerization, possibly by cyclization of the aliphatic material and subsequent dehydrogenation, give appreciable quantities of benzene and toluene, thereby increasing the petrochemical production of aromatic chemicals.

Other modifications of petroleum as a source of raw materials for petrochemicals are illustrated by the cracking or hydrogenation of selected liquid fractions derived from petroleum. The cracking of heavier petroleum distillates always yield appreciable quantities of olefins that can be converted directly to many of the petrochemicals by methods shown in Fig. 4. Still other companies already are, or soon will be, cracking the lowest cost liquid petroleum residues as a source of olefins for petrochemical manufacture.

Butadiene and benzene obtained by this method might be considered as byproducts or coproducts, with the lower olefins as the primary products. The Catarole process in England is illustrative of this method, starting with "gas-oil". This process has not been adopted in this country because of the abundance of natural gas for olefin production.

Today there are at least 143 different companies that make up the petrochemical industry. The 16 companies, shown in Figs. 4 to 6, may be considered the pioneers who have contributed most significantly to the development of petroleum processes.

Production of Major Aliphatics

From these basic petrochemical processes come the organic chemicals that have created the demand that has made the petrochemical industry possible. The growth of a few of the more important aliphatic chemicals is charted in Fig. 7. The production figures in these charts include both petrochemical and nonpetrochemical statistics. The 3,800 million pounds of ethanol for 1945 represents the production of the beverage industry as well as industrial fermentation and synthetic ethanol.

The 1952 ethanol production is estimated to have been 57 per cent petrochemically derived, methanol is 90 per cent, acetic acid is 95 per cent, and glycerol is 20 per cent. Ethylene oxide and ethylene glycol are 100 per cent petrochemically derived. It is interesting to note the particularly steep curves for ethanol, methanol, ethylene oxide, ethylene glycol, acetone, and acetic acid—a reflection on the broad usefulness of these oldtimers.

End uses . . . A breakdown of end uses for petrochemicals on a tonnage basis indicate that synthetic rubber takes one-fifth of all petrochemical production, principally as butadiene, styrene and carbon black. (See attached figure.) The next largest is automotive and aviation, contributed mainly by antifreezes and antiknock fluid. Synthetic fibers consume a large variety of petrochemicals. Cellulose acetate takes large quantities of acetic anhydride and acetone. Nylon uses benzene, cyclohexane, and butadiene as basic raw materials.

Dacron and Dynel, the all-petrochemical synthetic fibers, are made from terephthalic acid and ethylene glycol; and acrylonitrile and vinyl chloride, respectively. Acrylonitrile can be made either from ethylene oxide (petrochemical) or acetylene (petrochemical, if made from methane). Vinyl chloride is derived from either ethylene or acetylene.

Production of Aliphatics by Chemical Family

Almost 70 per cent of the 1952 production of petrochemicals were aliphatics. An analysis of the total aliphatics production shows that the hydroxy compounds make up the largest family and ethanol is the largest single member. Table I shows this breakdown as well as a similar breakdown for the following groups: aldehydes and ketones, halogenated compounds, acids and anhydrides, esters and oxides, and amines along with the largest member of each.

Tank-car petrochemicals . . . In the postwar period, 46 new petrochemicals have grown to tank-car stature. Many

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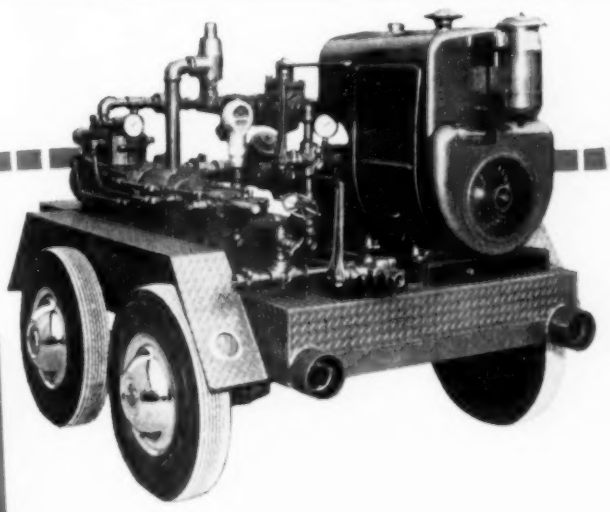

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TABLE I—PRODUCTION OF ALIPHATICS BY CHEMICAL FAMILY
(Billions of pounds in 1952)

Family—	Total	Petro-chemical	Largest member of family—	Total	Petro-chemical
Hydroxy compound	5.0	4.1	Ethanol	1.52	0.86
Aldehydes and ketones	2.4	2.0	Acetaldehyde	0.60	0.59
Halogenated compounds	2.6	2.4	Ethyl chloride	0.44	0.43
Acids and anhydrides	1.2	1.1	Acetic anhydride	0.69	0.69
Esters and oxides	1.3	1.0	Ethylene oxide	0.68	0.68
Amines	0.6	0.3	Hexamethylenediamine	0.08	

of these were still in the laboratories in 1940, their future applications unknown. Others did not reach the laboratory stage until the postwar period.

Among the six new hydroxy compounds, 2-butyl-2-ethyl-1,3-propanediol was found during World War II to possess insect repellent properties. Its commercial production and large scale use is very recent. The U. S. Quartermaster Corps is now including this diol in a military insect repellent formulation for clothing impregnation. (See Table 2.)

Diisobutyl carbinol has reached large volume in the past year as a special reaction medium and limited application in printing inks and lubricating-oil additives.

Isooctyl alcohol is the first large volume product to be synthesized by the Oxo process. Its availability has increased the supply of esters, such as the phthalate and adipate, for use as plasticizers for vinyl resins. Its low-volatile ester of 2,4-D acid found extensive use in the summer of 1953 as a weed killer.

The methoxy polyethylene glycols are available in three molecular weights, 350, 550 and 750, under the trademark of "Carbowax." Their fatty acid esters exhibit good emulsifying, dispersing, and wetting properties for aqueous processes encountered in the textile and leather industries. Alone, they are useful in certain ore flotation processes.

The propylene glycol alkyl ethers marketed under the trade-mark of Dowanol have found many applications similar to the older ethylene glycol series as lacquer solvents, hydraulic fluid components and agricultural emulsifiers and couplers.

The advent of nonyl phenol gave synthetic detergent manufacturers a versatile and economical hydrophobe. Reaction with various amounts of ethylene oxide yields non-ionic surface-active agents and detergents with a range of oil-soluble and water-soluble properties. Many of the well-known liquid detergents on the market today are based on nonyl phenol derivatives of this type.

Aldehydes and ketones . . . The most versatile of the new aldehydes is acrolein, which has been known in the laboratory since the 1890's. (See Table 2.) The first tank car was shipped in September 1952. Containing both an ethylene linkage and an aldehyde group, acrolein offers many possibilities in synthesis. It is the starting material for an important amino acide, methionine. It can also be used in place of glycerol in the Skraup synthesis for quinoline and substituted quinolines. Still another example of its versatility is its appliion in special resin-treatments to render textiles wrinkle and crease resistant.

Acrolein can be dimerized and the resulting dimer hydrolyzed to give an interesting aldehyde, alpha-hydroxy-adipaldehyde, an insolubilizing agent for protein and cellulosic materials. The corresponding hydroxy compound, 1,2,6-hexanetriol yields alkyd resins with interesting properties.

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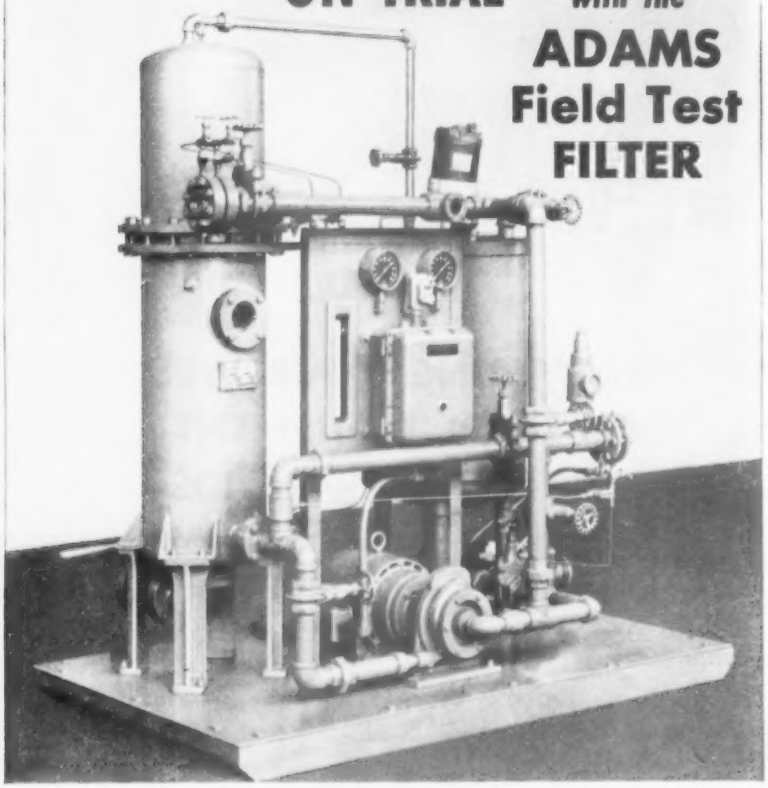

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September, 1953
69 wells

Per gallon cost of Nocor "102"	$ 1.50
No. of gallons used	189
Total cost of inhibitive material	$283.50

Average cost of Nocor "102" per well, per month **$4.11**

These 69 wells are located in the field major operators agree is the most corrosive known. With Nocor "102" ordinarily corrosive wells are even more economical to control.

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During the month of September, 1953, one company's full lease of 69 wells received a treatment of 189 gallons of Nocor "102". Total cost of Nocor "102" was $283.50.

September was the *sixth consecutive month* of full-lease treatment with Nocor "102" exclusively — *without a single failure in any well attributable to corrosion.* These wells range in water production from slight traces to extremes.

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Diisobutyl ketone is an economical, high-boiling lacquer solvent. Pyruvic aldehyde is an intermediate in the synthesis of the new insecticide **allethrin.**

Halogenated compounds . . . The growing requirements of agriculture for chemicals has given impetus to large tonnage production of seven new halogenated compounds. (See Table 2.)

Sodium dichlorphenoxyethyl sulfate under the trade-name "Crag" herbicide-1 and N (p-chlorphenyl) isopropyl carbamate (Chlor IPC) are new pre-emergence weedkillers. "Crag" herbicide is particularly effective against the germinating seeds of broad-lead weeds but has little or no effect on the foliage of nearby desirable plants. It is not an active herbicide as applied but, upon contact with the soil, is activated by soil organisms.

Chlordane, aldrin and dieldrin, which are chlorinated derivatives of cyclodienes, have found broad applications as insecticides against chewing insects—particularly DDT-resistant species.

Acids and anhydrides . . . The new acids and anhydrides are acrylic acid, alkenyl succinic acids, 2,4,5-T acid, peracetic acid, and terephthalic acid. (See Table 2.)

Terephthalic acid (generally made in form of methyl ester for convenience in use) probably has the greatest future of any of the new acids. The polyethylene terephthalates are being marketed as Dacron synthetic fiber, Mylar film and photographic film. Terephthalic acid is obtained by oxidation of p-xylene which, upon esterification with ethylene glycol, gives the first entirely "petrochemical textile fiber."

2,4,5 - Trichlorphenoxyacetic acid (2,4,5-T) is a postwar advance over

(Continued on page 119)

TABLE 2—PETROCHEMICAL FAMILIES

Hydroxy compounds:	Million lb.
Production total	5,000
Largest tonnage—ethanol	1,520

New tank-car petrochemicals since 1945:
Butyl ethyl propanediol; Methoxy polyethylene glycols; Diisobutyl carbinol; Propylene glycol alkyl ethers; Isooctyl alcohol; Nonyl phenol

Aldehydes and ketones:	Million lb.
Production total	2,400
Largest tonnage—acetaldehyde	600

New tank-car petrochemicals since 1945:
Acrolein; Ethylhexaldehyde; Diisobutyl ketone; Pyruvic aldehyde; Trioxane

Halogenated compounds:	Million lb.
Production total	2,560
Largest tonnage—ethyl chloride	440

New tank-car petrochemicals since 1945:
Chlor IPC; Dichlorbutene; Chlordane; Dieldrin; Aldrin; Epichlorhydrin; Sodium dichlorphenoxyethyl sulfate

Acids and anhydrides:	Million lb.
Production total	1,200
Largest tonnage—acetic anhydride	690

New tank-car petrochemicals since 1945:
Alkenyl succinic acids; 2,4,5-T acid; Acrylic acid; Peracetic acid; Terephthalic acid

Esters and ethers:	Million lb.
Production total	1,300
Largest tonnage—ethylene oxide	680

New tank-car petrochemicals since 1945:
Allethrin; Maleic alkyl esters; Diallyl phthalate; Octyl adipate; Dibutyl "Carbitol"; Octyl phosphate; Diglycol dibenzoate; Octyl hexahydrophthalate; Ethyl and methyl acrylates; Vinyl alkyl ethers; Ethyl ethoxypropionate; Parathion; Dimethyl carbate

Amines:	Million lb.
Production total	600
Largest tonnage—hexamethylenediamine	75

New tank-car petrochemicals since 1945:
Dimethyl formamide; Gamma picoline; Heptadecyl glyoxalidine; Alpha picoline; SR 406; Methyl ethyl pyridine; Methyl vinyl pyridine; n-Butyl acetanilide

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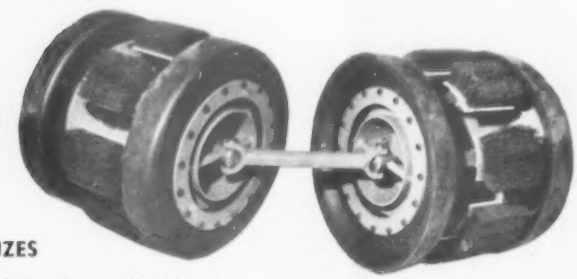

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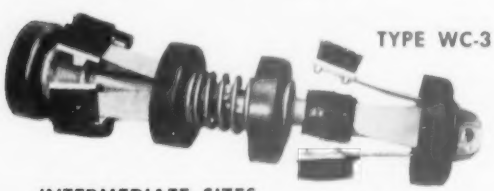

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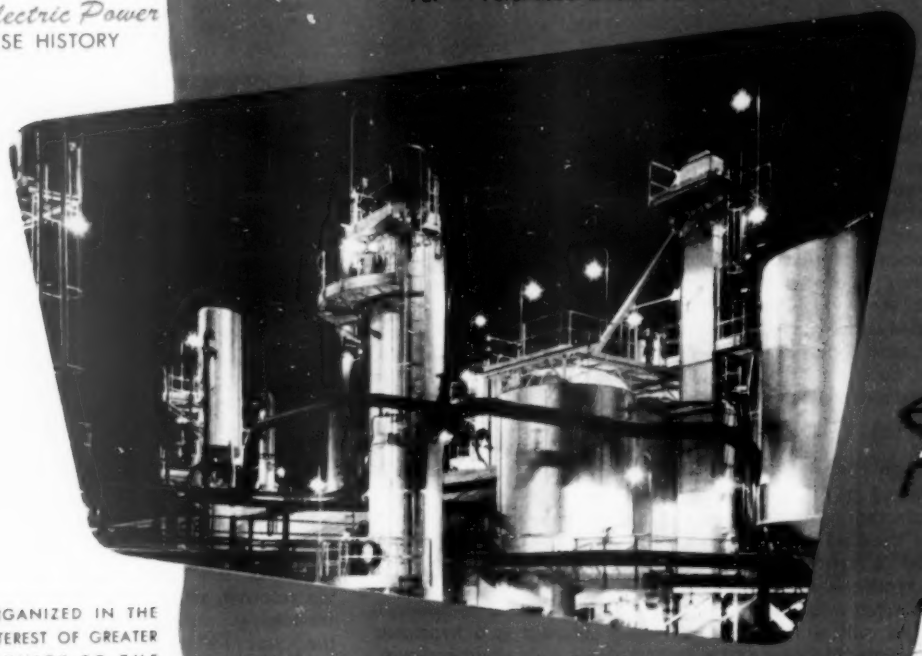

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PETROCHEMICALS TODAY:

The Role of Natural Gas in Petrochemical Manufacture

Natural gas provides a readily available supply of carbon and hydrogen for synthesis of petrochemicals. It is in the gaseous state, usually under pressure, and ready for use. In making synthesis gas, gas shows several advantages over coke. Impurities are usually low, and those present are readily removable.

by F. D. Kuenzly

STARTING with any of the raw materials used, the synthesis of ammonia consists of three distinct process steps, which are:

1. The production of the crude hydrogen-nitrogen mixture.
2. The purification of the hydrogen-nitrogen mixture.
3. The synthesis of ammonia by chemically combining one atom of nitrogen with three atoms of hydrogen at elevated temperatures and pressures with the aid of a catalyst.

Raw Materials

Fortunately there is an unlimited supply of nitrogen from the air, the latter being abundant, reliable and cheap.

For the other component, hydrogen, there is also a relatively cheap raw material, water, which is used as a source of hydrogen in two ways, firstly, as process steam in the most important processes and, secondly, by electrolysis. The other raw materials are coal and natural gas.

Hydrogen sources . . . High purity electrolytic hydrogen obtained as a by-product from the manufacture of caustic soda and chlorine by the electrolysis of sodium chloride brine is highly satisfactory for ammonia synthesis. However, its total supply is limited in quantity and it is available at only a few locations in sufficient amounts to make ammonia manufacture from it economically attractive. There are seven ammonia plants using by-product electrolytic hydrogen.

Coke-oven gas, containing about 50 per cent hydrogen is obtained as a byproduct in converting coal to coke. This gas has been used in Europe in several ammonia plants but has not been used in this country for ammonia manufacture.

It is understandable that the first large-scale ammonia plants used coke as the raw material. It is also inevitable that a raw material with the advantages of natural gas would find its place in the synthetic ammonia industry. Thermal cracking of natural gas was employed in the Pittsburg, California, plant of Shell Chemical, the first plant in the world to use this raw material for ammonia synthesis.

Because of increased thermal efficiency, all subsequent natural gas use has been based on the steam-methane process and in the present expansion program, it is believed that four plants will use partial combustion of natural gas with high purity oxygen. There are 14 plants now using natural gas which should increase to about 26 with the completion of present expansion program in 1955.

The nitrogen for the hydrogen-nitrogen mixture can be obtained from air by either of two methods. The one most commonly used removes the oxygen by combustion with hydrogen, hydrocarbons or carbonaceous materials. The second method liquefies air and fractionates the liquid into its components, oxygen being obtained as a byproduct.

It is relatively simple to obtain the necessary nitrogen from air but it is the production of hydrogen and the purification of the hydrogen-nitrogen mixture that entail the major costs in the manufacture of ammonia.

Semi-water gas process . . . In preparing ammonia synthesis gas from coke via the cyclic semi-water gas process, steam is reacted with incandescent coke to produce "blue" gas, a mixture of carbon monoxide and hydrogen with a smaller quantity of carbon dioxide. In order to restore the heat used by the endothermic water-gas reaction, air is passed over the coke bed during which time "producer" gas is made. "Producer" gas contains the nitrogen from the air together with carbon monoxide and carbon dioxide.

By mixing the blue gas and producer gas in the proper proportion, a semi-water gas containing the required 3 to 1 ratio of hydrogen to nitrogen is obtained. In order to reduce the carbon monoxide content of the gas and at the same time produce more hydrogen, the water-gas shift reaction is employed. The gas is passed over an iron oxide catalyst at about 750° F. in the presence of excess steam. The carbon monoxide and steam react to produce carbon dioxide and hydrogen.

Because crude semi-water gas and crude synthesis gas obtained from natural gas via the steam-methane process contain the same impurities, the purification of these two gases is done by the same process steps.

Steam-methane process . . . In the conventional steam-methane process, the gas reformer normally operates approximately at atmospheric pressure. At the Ventura Plant this process has been modified slightly so that the gas reformer operates at elevated pressure to reduce compression costs. Steam and natural gas are reacted at about 1,400° to 1,500° F. with the aid of a nickel catalyst contained in alloy tubes suspended vertically in the reforming furnace. Combustion gas outside the tubes supplies heat for the endothermic reaction which produces a mixture of

Author with Shell Chemical Corp., Ventura, Calif. Presented before the California Natural Gasoline Association fall meeting.

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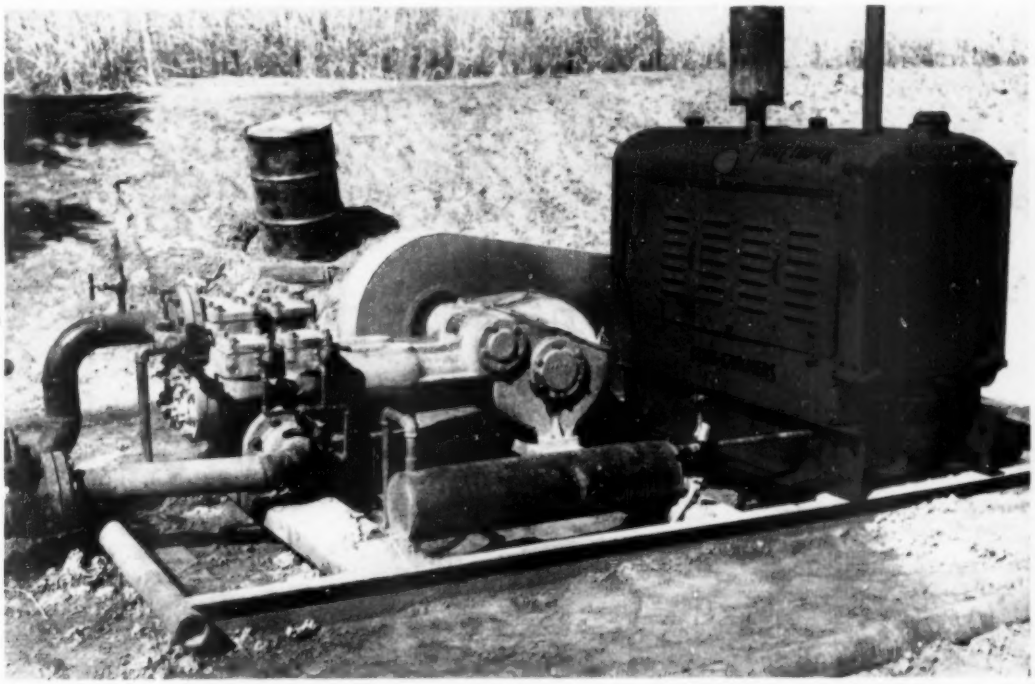

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hydrogen, carbon monoxide and carbon dioxide.

The nitrogen is obtained by injecting air into the crude gas in a secondary reformer, also charged with nickel catalyst. The combustion that takes place raises the temperature to about 1,700° to 1,800° F. at which temperature all the oxygen in the air is consumed and the residual methane is reduced to about 0.5 per cent or less.

The gas is then cooled to about 750° F. either by a waste heat boiler or by direct water quenching, the latter method being employed at the Ventura Plant. The water-gas shift reaction is then used to reduce the carbon monoxide content of the gas as is done in the semi-water gas process.

Composition of crude gases . . . Reference to Table 1 shows the composition of the crude gases produced from the various raw materials and processes used so that both the types and amounts of the impurities to be removed can be seen.

The purification step is one of the most important in the ammonia synthesis process because both carbon monoxide and carbon dioxide are severe ammonia catalyst poisons and must be reduced to about 10 parts per million for the best synthesis converter performance.

Carbon dioxide removal . . . The major portion of the carbon dioxide is removed by either of two methods. The one first used was water scrubbing at pressures ranging from 200 to 400 psig. to reduce the carbon dioxide content to about one per cent. The other method that is gaining widespread use is the Girbotol system which utilizes a monoethanolamine solution at pressures ranging from atmospheric to about 250 psig. to reduce the carbon dioxide content to about 0.1 per cent. At the Ventura Plant, the Girbotol process is used with the absorber operating at 200 psig.

There are two factors favorable to the Girbotol process. First the solubility of the synthesis gas in the Girbotol solution is much lower than its solubility in water, the gas lost by solution in the Girbotol system is practically negligible compared to losses up to 5 per cent suffered with water scrubbing, depending upon the pressure. Second, the carbon dioxide obtained on regeneration of the Girbotol solution is consequently of high purity which is important if further processing of carbon dioxide is to be carried out, such as the manufacture of dry ice or the production of urea from carbon dioxide and ammonia.

Carbon monoxide removal . . . After removal of carbon dioxide, the gas is compressed to about 2,000 psig. at which pressure carbon monoxide is removed by scrubbing the gas with a copper ammonia acetate solution, commonly called copper liquor. The copper liquor is regenerated by heating and re-used.

Usually, and as done at the Ventura Plant, the gas is next scrubbed with caustic soda for the removal of the last traces of carbon dioxide after which it is ready for final compression for the ammonia synthesis step.

Ammonia synthesis . . . In the synthesis of ammonia it is necessary to use a pure gas mixture, high pressure, a relatively high temperature in the range of 900° to 950° F. and an active catalyst to speed up the reaction of the hydrogen with the nitrogen. Because of the equilibrium involved, only partial conversion of the gases to ammonia can be obtained for each pass over the catalyst. In order to get efficient yields, it is necessary to recycle the unconverted gas over the catalyst after the ammonia formed has been removed. The gas from the converter usually contains in the order of 15 to 20 per cent ammonia.

Pressure aids in increasing the equilibrium ammonia content and pressures ranging from 100 to 1,000 atmospheres have been used commercially, the optimum pressure depending mainly upon the purity of the synthesis gas feed. The majority of the plants, including the Ventura Plant, operate in the 300 atmosphere range.

Because the formation of ammonia has an appreciable heat of reaction, no external source of heat is required once the converter is in operation. Conversely the heat of reaction must be dissipated and the gases further cooled to recover the ammonia product by condensation. To reduce the ammonia content in the gas to about 3 per cent, water cooling is used, and in those plants operating below 600 atmospheres, it is also necessary to use ammonia refrigeration. After removal of the liquid product, additional make-up gas is added and the gas recirculated over the catalyst in a continuous manner.

Any inert gases in the feed gas, such as residual methane from the gas reforming step or argon from the air injected to supply the nitrogen, accumulate in the synthesis circulating gas. The inert gas content is controlled between 10 and 20 per cent by continuously purging a small amount of the circulating gas which causes about a 5 per cent loss in feed gas.

At the Ventura Plant, the liquid anhydrous ammonia product is stored at 50 psig. pressure in two spheres 65 ft. in diameter. Each sphere holds approximately 26,000 bbl. or 110 25-ton tank cars in which the ammonia is shipped. These spheres and a similar one located at Kerman, near Fresno, Calif., are believed to be the largest ever built for storing anhydrous ammonia.

Advantages of Natural Gas Over Coke

The several advantages of natural gas over coke leading to economics in favor of natural gas are:

1. Natural gas is already in the gaseous state, usually available under pressure ready for use. This eliminates capital tied up in coke storage, and that for solids-handling facilities for unloading, storing and charging coke to the water-gas generators.

TABLE 1—TYPICAL COMPOSITION OF CRUDE HYDROGEN GASES

Component mol %	Process: Electrolytic byproduct	Semi-water gas	Steam-methane	Pyrolyzed nat. gas
H_2	99.5	51.3	60.0	88.0
CO		3.5	3.0	2.5
CO_2		27.3	16.2	0.1
O_2	0.5	0.1	0.1	0.1
CH_4		0.5	0.5	6.3
C_nH_m				1.0
N_2	—	17.1	20.0	2.0
A		0.20	0.24	
Total	100.0	100.0	100.0	100.0

TABLE 2—ESTIMATED U.S. SYNTHETIC AMMONIA CAPACITY AND PRODUCTION

Year	Per cent capacity based on—Coke	Byprod. H_2	Nat. gas	M short tons NH_3—Annual capacity	Annual production
1925	49	51		19	16
1930	93	7		197	142
1935	89	5	6	417	182
1940	86	6	8	460	435
1945	59	3	38	1593	1100
1950	55	3	42	1940	1566
1952	44	6	50	2118	2020
1955	12	7	81	3485	

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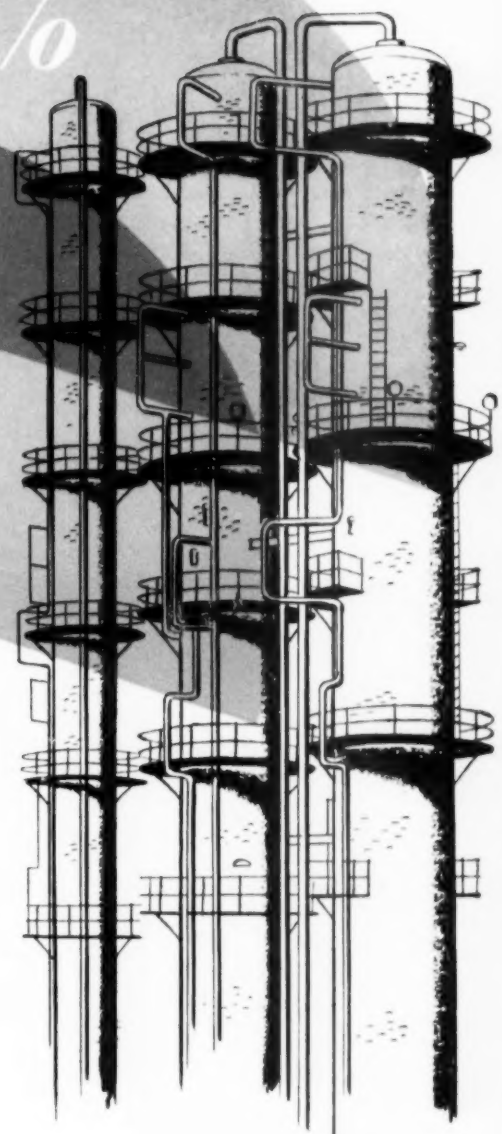

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High liquid thruput	−	+
Low pressure drop	−	+
High pressure drop	+	−
High pressure towers	−	+
Low pressure towers	+	+
Alloy or alloy-clad towers	−	++
Shop fabricated towers	−	+
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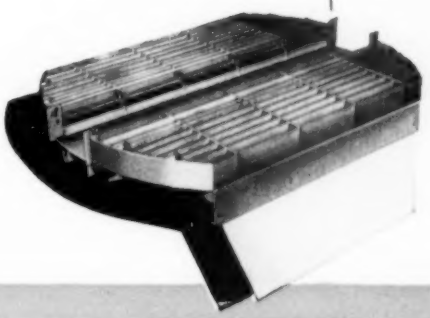

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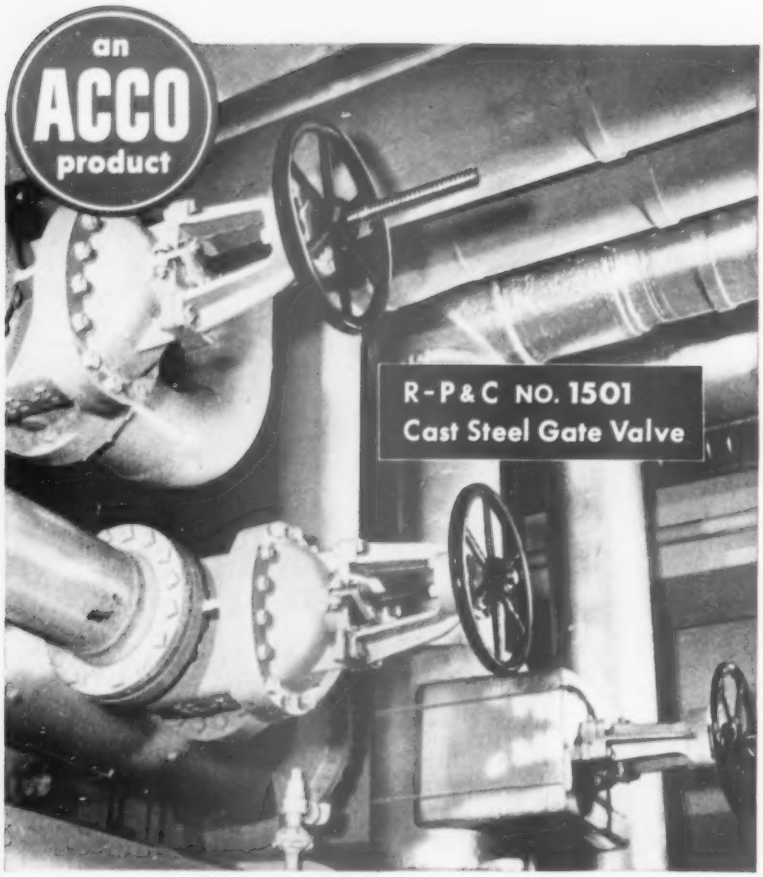

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2. There is no ash to dispose of when the steam-methane process is used.

3. In the purification step, there is only about half as much carbon dioxide to be removed, per unit of ammonia, from steam-methane gas than from semi-water gas.

4. In the natural-gas supplies used for ammonia synthesis, impurities such as sulfur compounds are usually very low and their removal is more simple than in the case of coke which inherently contains sulfur in amounts that are significant.

5. To produce only the crude hydrogen-nitrogen mixture required for the synthesis of ammonia, approximately 35 M.c.f. of natural gas per ton of ammonia are required compared to about 1.4 tons of coke. In both cases, the above figures include the raw materials consumed both in the production of the hydrogen and the steam used in the gas-producing processes. If 30 cents per M.c.f. is paid for natural gas, then coke would have to sell for $7.50 per ton to be competitive, whereas, it is quoted from $10 to $15 per ton in the coal mining areas.

6. Natural gas can be used directly in gas engines for driving compressors, resulting in both lower operating and capital costs for compressors and their power supply than for the case where steam or electric power, based on coal, is used for compressor drives.

In Table 2 the ammonia capacity based on the three raw materials used is shown for 5-year intervals starting in 1925. Thus, the spectacular growth that natural gas has made as a raw material for ammonia manufacture can be seen.

If ammonia plants are required beyond the presently planned capacity, they will undoubtedly be based on natural gas of byproduct hydrogen. The building of new plants based on coke is thought to be unlikely.

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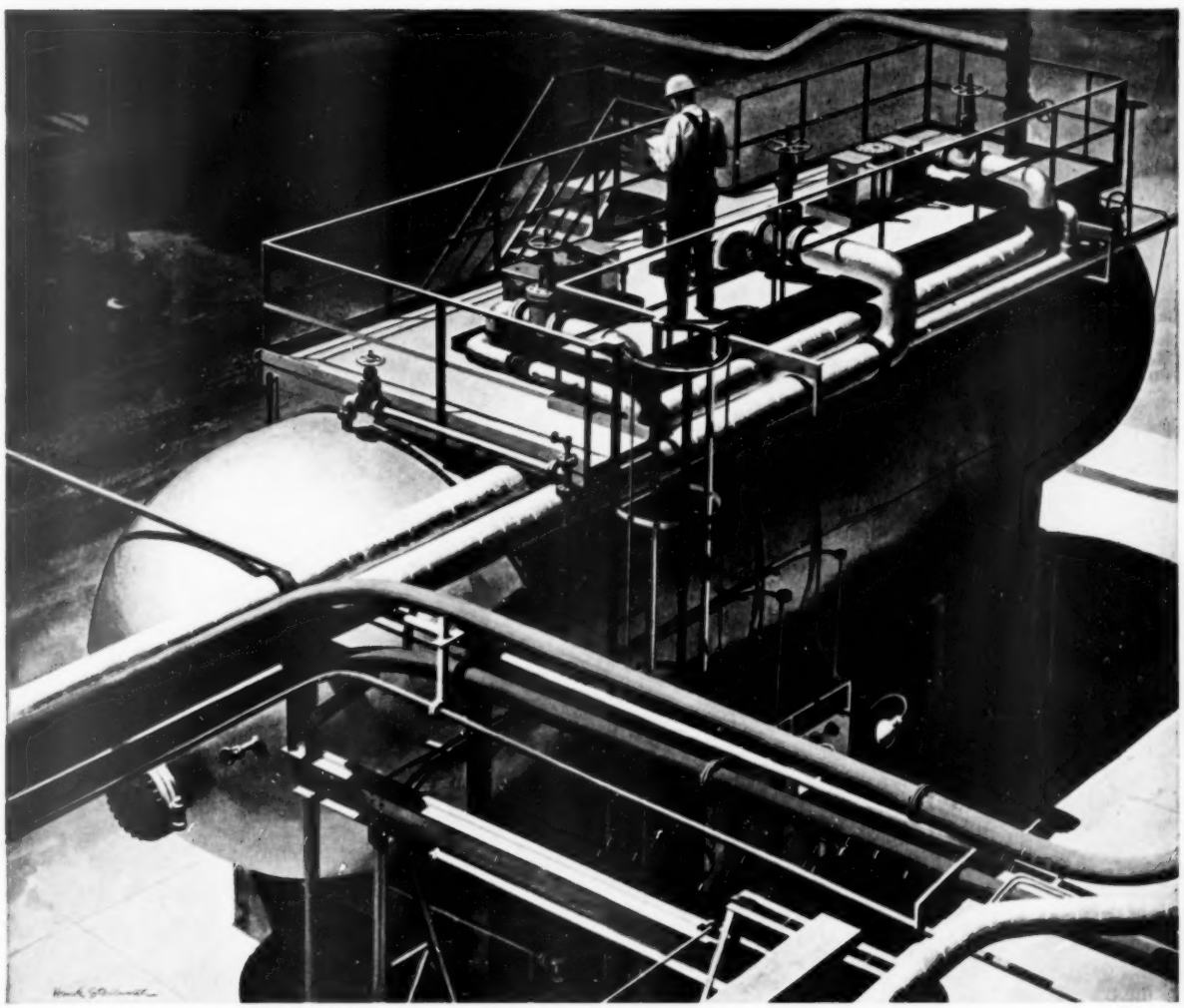

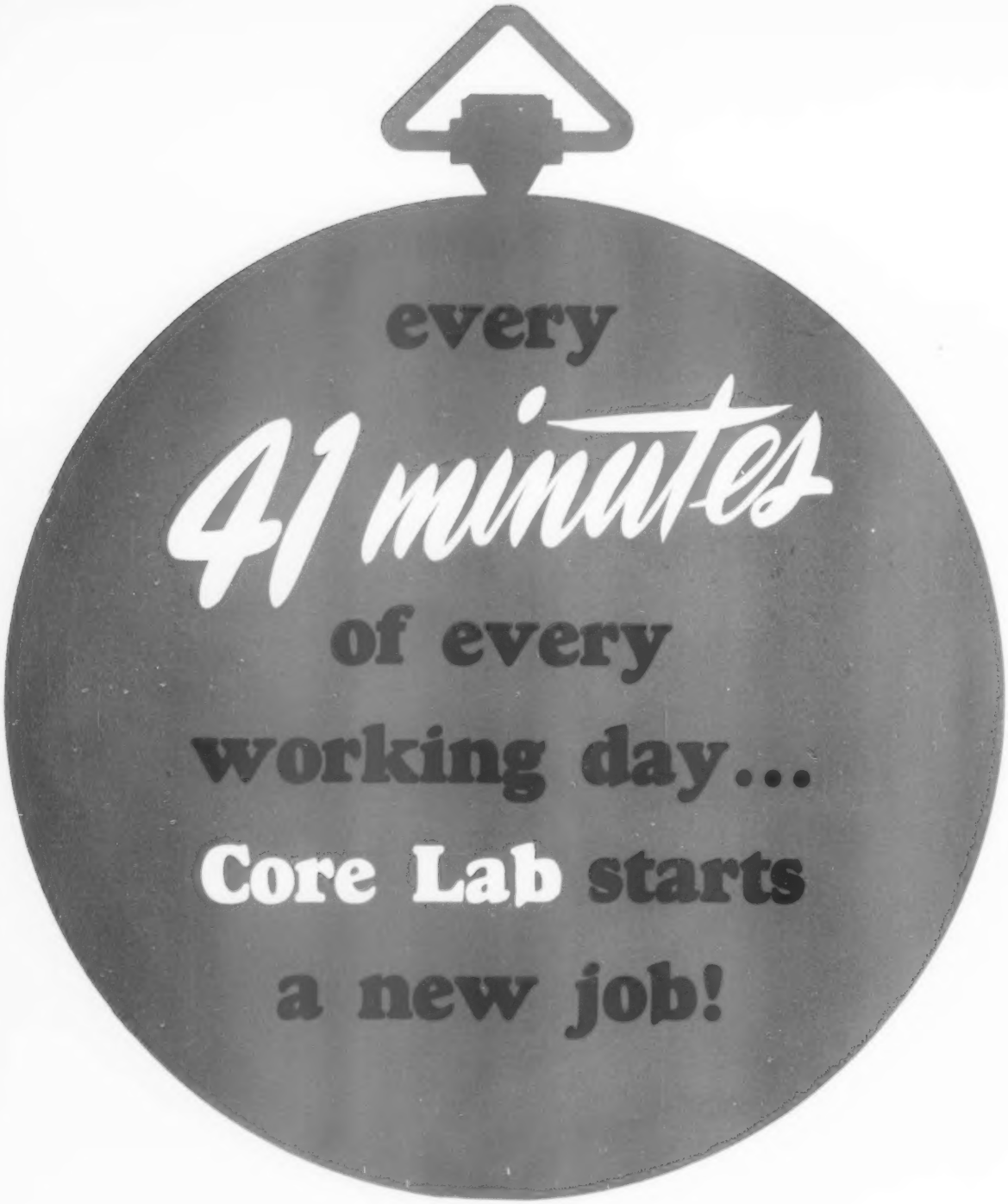

"Providing more reservoir revenue . . . through the production of more recoverable oil."

1952 Petrochemicals

(Continued from page 110)

2,4-D that offers the added advantages of effectively controlling woody plants, such as mesquite, and greater safety (less drift) in application.

Peracetic acid is employed in the bleaching of textiles. Acrylic acid in polymer form is a special textile size, and an intermediate for soil conditioners. The alkenyl succinic acids are inhibitors for special oils and lubricants.

Ester and ethers . . . The esters and ethers are the largest group of new tank-car petrochemicals and make up the greatest diversity of end uses. (See Table 2.)

Allethrin is the new insecticide that decreases our dependence on imports of pyrethrum. Like the pyrethrins, allethrin has low toxicity to warm-blooded mammals and quick knockdown characteristics for flying and crawling insects.

U. S. Industrial Chemical and Benzol Products are now operating commercial plants and Union Carbide will be ready to produce from a large scale plant in early 1954. At a selling price of $32 per pound, allethrin has not been and is not likely to be shipped in a tank car. If this method of shipment were employed, a 4,000-gal. tank car (30,000 lb.) would be the first million dollar petrochemical tank car.

Diallyl phthalate played an important part in the first low-pressure laminating resins and may be regarded as the forerunner of the polyester resins.

The alkyl maleic esters are monomers for vinyl type resins, intermediates for surface-active agents of the sulfosuccinate type, and for the new insecticide, Malathon.

It is not unexpected that the esters should also contain a number of plasticizers for synthetic resins. The ethylhexyl or isooctyl adipates are low-temperature plasticizers for vinyl resins. In addition, they are finding increasing application as synthetic lubricants for jet engines. Ethylhexyl phosphate is also a low-temperature plasticizer for vinyl resins. Ethylhexyl hexahydrophthalate is a general-purpose plasticizer, particularly well suited for organosol and plastisol dispersions—a large volume field that has expanded quickly and is still growing.

Polymers of vinyl alkyl ethers are used in pressure-sensitive adhesives, and are of interest as viscosity index improvers and pour-point depressants for special lubricating and hydraulic oils.

Dimethyl "carbate," a derivative of cyclopentadiene, is a military insect repellent for application to the skin.

Amines . . . Eight new petrochemical amines have grown to tank-car volume. (See Table 2.)

2-Heptadecyl glyoxalidine, under the name "Crag" fruit fungicide 341, is particularly effective against apple scab and cherry-leaf spot. "Crag" 341 has been developed into a large volume product since 1949. Fungicide SR-406, now called Captan 406, is another fungicide of wide utility on a variety of crops. n-Butyl acetanilide is another ingredient of the military insect repellent mixture for clothing impregnation. Dimethyl formamide is a nylon spinning solvent.

2-Methyl-5-ethyl pyridine, gamma and alpha picolines, and methyl vinyl pyridine are related products in that they all are substituted pyridines. 2-Methyl-5-ethyl pyridine's big use is in the manufacture of niacin, a part of the Vitamin B complex. Gamma picoline is a starting point for the TB drug, isonicotinic hydrazide. Methyl vinyl pyridine and 2-vinyl pyridine, the latter made from alpha picoline are monomers that have interesting potential uses in special synthetic rubber latices as a predip for nylon cords. Methyl vinyl pyridine is also used in acrylonitrile fibers to enhance dyeing properties.

Alkylated aromatics and dodecyl benzene are the two petrochemicals that are intermediates for the still expanding synthetic detergent industry.

Review of the applications for the 46 new postwar petrochemicals that reached tank-car stature reveals that 40 of them grew to their present size by finding markets in the fields of agriculture, plastics, synthetic fibers, specialty rubbers, drugs and detergents. (See Table 3.)

The predominance of these industries in the postwar period might have been expected because it is here that the largest expenditures both for basic and application research have been made. From 1945 to 1952, the growth in markets for chemicals in agriculture has increased ninefold; markets for synthetic detergents have quadrupled; for plastics, tripled; for synthetic fibers near doubled (this expansion is several times greater when acetate is excluded); and for drugs, doubled. (See Table 4.)

Looking to the next few years, total petrochemicals production in 1955 should rise to 31.5 billion pounds. A breakdown of this total indicates that aliphatics will represent 19.4 billion pounds; aromatics, 3 billion pounds; and inorganics, 9.1 billion pounds. Taking into account the continued high expenditudes for both new plants in the petroleum industry and in research, these figures can be attained. By 1955 the petrochemical industry will occupy even a larger proportion of the chemical industry than it now does and by that time should have 4 billion dollars invested in plants producing petrochemicals with a value of 4 billion dollars.

Acknowledgment

The authors wish to acknowledge the assistance of P. R. Rector and A. T. Nelson in the compilation of statistics and preparation of this paper.

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TABLE 3—NEW TANK-CAR PETROCHEMICALS SINCE 1945

Family—	End-use application					
	Agriculture	Plastics	Fibers	Rubbers	Drugs	Detergents
Hydroxy	1	1	2			1
Acids	1		3			
Esters	3	7		1	1	
Aldehydes	3				1	
Halogenated	4		1			
Amines	3		2	1	2	
Hydrocarbons						2
Total	15	8	8	2	4	3

TABLE 4—UNITED STATES PETROCHEMICAL PRODUCTION

(Billions of pounds)

	1930	1940	1950	1951	1952	1955
Total petrochemicals	0.48	2.39	16.14	20.14	21.38	31.5
Aliphatics	0.10	1.30	11.77	14.72	14.3	19.4
Aromatics		0.05	0.95	1.19	1.68	3.0
Inorganic	0.38	1.04	3.42	4.23	5.4	9.1

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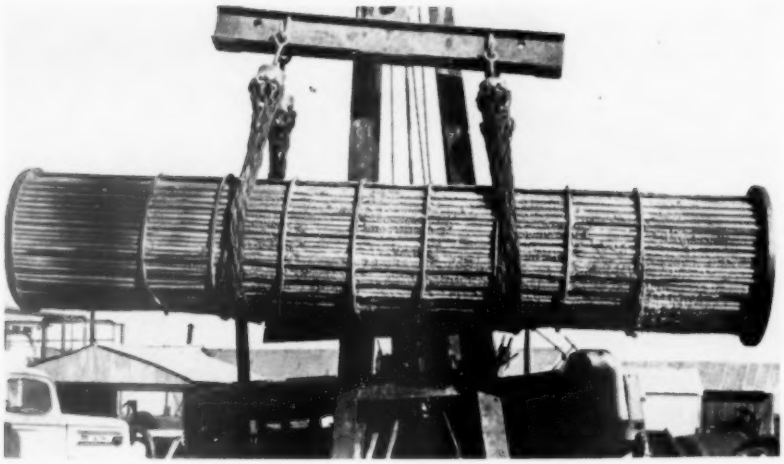


FOULED BUNDLE is lifted by tractor for setting on tube-bundle carts. Carts are then rolled into furnace.

PETROCHEM REPORT

How Neches Butane Solves Tube-Bundle Cleaning Problems

Hard, brittle polymer deposits are removed by controlled burning in special furnace.

by Frank R. Jelinek

THE ever-present maintenance problem of cleaning heat exchanger tube bundles has partially been solved at the Neches Butane Products Co., the world's largest butadiene plant at Port Neches, Tex. This has been accomplished by controlled burning of the deposits in a furnace.

At Neches, furfural is employed as a selective solvent in several of the fractionating towers to effect the separation of butylene-1 from isobutane, butylene-2 from normal butane, and butadiene from butylene-1. Furfural has chemical properties which at certain operating conditions result in polymer formations on heat exchangers, reboilers, and furfural coolers. The deposit is hard, strong, and brittle and in many instances is harder than the Admiralty tubes which are used in most of the tube bundles.

In certain other sections of the plant, a sticky, rubbery deposit is found on the tube bundles which it is believed to be a polymerized form of butadiene. This material is rubbery and has a great adhesive strength and is very difficult to remove from the tubes.

Author is chief engineer, Neches Butane Products Co.

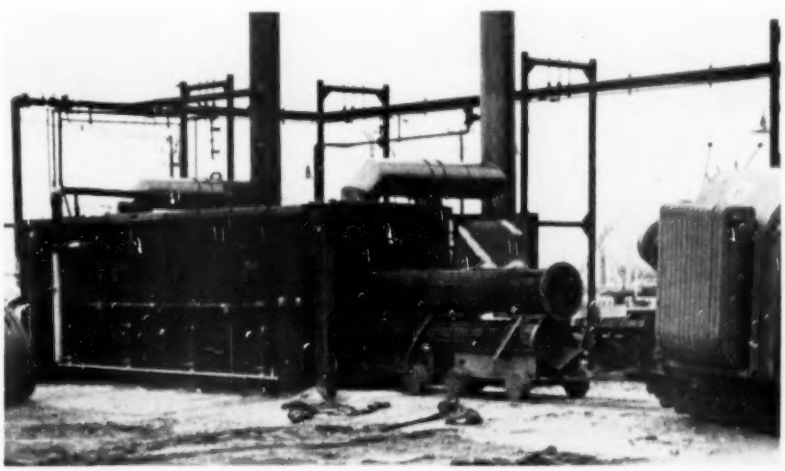
Bundle types . . . Most of the tube bundles at Neches are of the conventional two-pass floating head tubesheet type of construction. However, there are also a number of hairpin tube bundles which are used in stripper tower reboiler services. Bundles vary in diameter from 12 to 46-in. and are fitted with 16-ft. long tubes of either carbon steel or Admiralty. Tubesheets are either solid naval bronze or naval bronze cladding on steel. Baffles, tie-rods and spacers are of steel.

Neches has employed tube bundle cleaning methods comparable to those in use throughout the petroleum industry which included:

1. Drilling of the inside of the tubes.
2. Sawing of the deposit lodged on the outside and in between the tubes.
3. High-pressure water washing.
4. Sandblasting, both wet and dry.
5. Burning of the outside of the tubes with an open flame, with or without cooling steam.
6. Solvents.

All of these methods have been found to be time consuming and costly. However, the biggest objection to these methods is that total surface cleanliness is not attained. On occasions, bundles may be so densely fouled that it is necessary to retube the bundle even though the tubes have not reached their ultimate life. In addition, some damage to tubes results from these cleaning methods inasmuch as the drills and saws have scarred or ruptured the tubes, the sandblasting has pitted the tubes, and the open flame has caused excessive warpage.

From an operational standpoint, none of these methods effectively cleaned the tubes since calculations indicated that after cleaning, the heat transfer was only from 45 to 73 per cent as compared to a new clean bundle. Also, these figures showed that, since the K value of a cleaned bundle was about half that of a new bundle, the bundles had to remain in service until the K value dropped to a relatively low figure, usually 10 to 35 per cent that of a new bundle before cleaning was justified.



TWO BUNDLES are here being removed from the furnace after deposits have been burned off. Bundle carts are moved by tractors.

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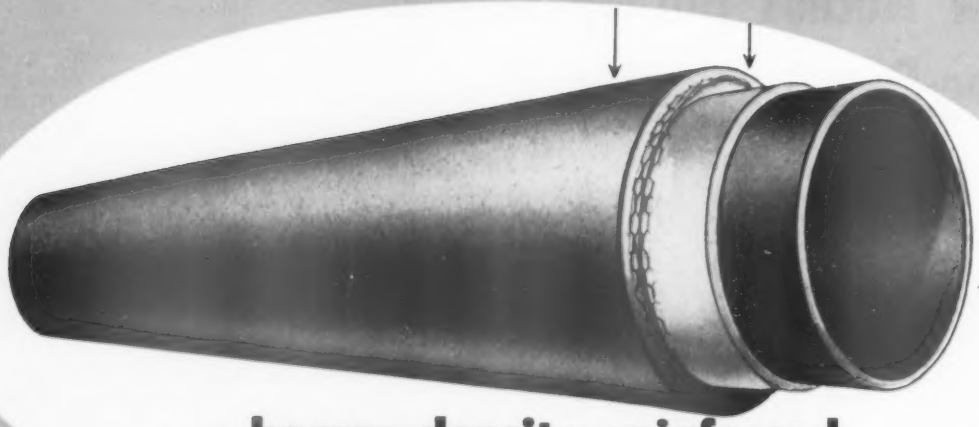

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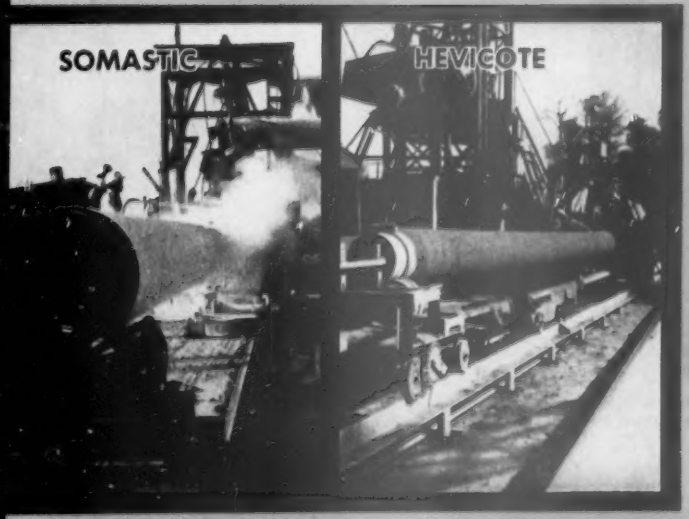

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CLEANED BUNDLE is shown after treatment. Pile of material in left foreground is that which was blown from the bundle.

Tests started . . . In view of the unsatisfactory cleaning results that were being obtained and the resultant downtime and loss of production because of frequent bundle change-outs, studies and tests were started in 1945 to determine if controlled burning by heating of the polymer was possible. These studies also included runs to determine if the steel and Admiralty tubes would be impaired by heating at elevated temperatures.

At the time Neches was investigating this problem, the Southern California Gas Co. was also conducting a similar study and in 1946 constructed a furnace which successfully demonstrated that polymer could be removed by controlled oxidation. On the basis of additional information secured from the Southern California Gas Co., plans were prepared for a like installation at Neches, which however were dropped when curtailed plant operations indicated an unfavorable payout of the furnace installation.

With the resumption of full plant operation in 1948, the project was revived and in August 1949 the tube bundle cleaning furnace installation was completed.

The furnace is set on a concrete slab which is covered with fire brick. The oven proper is of ¼-in. steel with the inside covered with a vermiculite-luminite cement insulation suitable for a temperature of 1,200° F. and the outside with an ¼-in. thickness of Type D Insul-Mastic. At the front are mounted double doors for the entry and removal of the bundles and bundle carts which run on rails. At the left rear is a single door suitable for the entry of workmen to facilitate the handling of the carts and bundles. The venturi-type burner and flame tunnel are located at the rear of the furnace. The flame tunnel is 7 ft. long and is constructed of steel pipe, lined with refractory and with provision for the introduction of 150 psig. cooling steam downstream of the burner.

The flame tunnel was used since it was important to prevent flame impingement on any part of the bundle. To the left and rear of the furnace proper, the instrumentation panel and operator's shelter were erected. Two stacks are provided, originally it being intended to use the front stack for hairpin bundles and the rear stack for floating head bundles.

In the event that localized burning takes place on a bundle, snuffing steam on one or both sides may be injected into the furnace at the point at which burning is taking place. The burner has a regulated gas supply with a manually operated needle valve for gas flow control.

The burner also is suitable for primary air supply of compressed air with atmospheric aspirators on both the gas and the air. The flame tunnel is equipped with a lighting port which also doubles as a flame inspection port, a Protecto-Glow for flame failure, ports for injecting smothering steam to protect the refractory, and 150 psig. cooling steam to prevent active flame from entering the furnace. An 8-point strip chart fast-reading recorder indicates the temperatures in the furnace stacks and in the bundle, one point in the stack, one point in the flame tunnel, and six flexible thermocouples which are inserted between the tubes in the bundles. A bundle is rolled into the furnace on carts which roll on tracks that also extend out in front of the furnace.

Design factors . . . The main considerations in the design of the furnace were:

1. A means to heat the coke on the bundle to a temperature that would completely oxidize the material.
2. No active flame in the furnace or on the bundle.
3. Limiting temperatures to preclude damage to tubes, tubesheets, and baffles and to prevent hardening or annealing of tubes.
4. Operation which would keep to a minimum the rerolling of tubes.
5. Means to control the furnace temperature at all times and to snuff out localized burning of the polymer.
6. Means to remove polymer from the inside of tubes which is accomplished with the adapters which fit over a tubesheet nearest the flame tunnel and are connected to the rear stack, thus causing the hot gases to go around the outside of the bundle, through the tubes, and out the rear stack while for hairpin bundle a "half" adapter is used which is fastened to the top half of the bundle.
7. Dampers in the stacks to control temperatures, hot gas flow, and to some extent, oxidation of the polymer (as indicated by an orsat).

Cleaning procedure . . . The following is the general procedure that is used to clean a bundle:

1. The furnace is purged with steam for 15 minutes after a bundle has been placed in the furnace.
2. The burner is lighted.
3. Smothering steam is introduced into the flame tunnel.
4. The front stack damper is adjusted depending upon wind velocity and the temperature brought up at the rate of 50° F. to 75° F. per hour until the specified temperature is reached which is usually from 750° to 850° F. depending upon the amount of polymer deposited on the tubes. From 900 to 1,000 lb. per hour of smothering and cooling steam are required.
5. The gas burner is fired at a constant gas pressure of 3 psig. and 35 psig. primary air pressure. The chart recorders are watched and adjustments are made to the stack damper to maintain constant temperatures.
6. The bundle is then allowed to "soak" for a period of from 10 to 40 hours, again depending upon the type and amount of polymer.
7. After the soaking period is completed, the furnace temperature is reduced from 50° F. to 75° F. per hour until it is cool enough to enter to remove the bundle.
8. The bundle is blown clean with air.

(Continued on page 131)

Building

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Progress on Permanent-Type Completions

During the past three years, several hundred wells in the Gulf Coast have been completed with "permanent-type well completion" equipment. Most immediate benefit was the saving of one or two rig days because wire line tools performed operations that would ordinarily require the retention of a rig.

However, the real purpose in permanent completion concepts is to reduce the expense of workovers, not only to save money on needed jobs but also to make possible those jobs that would not otherwise be economically justifiable. Therefore, the 75 per cent saving reported on certain types of workovers by Humble Oil & Refining Co., who pioneered the methods, indicates success of that purpose.

Initial efforts in developing this technique were attended by the instances of failure that must be expected in the development of a new idea. Nevertheless, Humble, with the cooperation of several manufacturers, has continued to perfect the equipment, which has been the limiting factor.

The first development that showed the real possibilities of "wire line workovers" was the providing of a perforating gun that is small enough to be run through the tubing, yet powerful enough to penetrate the casing and cement sheath. An added feature of the gun is that the carrier is self-destructible and need not be recovered.

The necessity of unloading the permanently completed well has led to the design of a gas lift system that incorporates wire line retrievable valves and full opening mandrels. This system also provides permanent artificial lift means and facilitates circulation or cementing.

Retrievable extension pipe made of aluminum to run on 0.082-in. measuring line, is successfully used to clean out and to spot cement for plugging or squeezing. A suitable inhibitor in the acid will permit acid treatment through this aluminum pipe.

Tubing wear and small diameter landing nipples that rod pumping entails, make gas lift seemingly the most satisfactory artificial lift for permanent-type completions. However, pumping equipment is being utilized satisfactorily.

Work is currently in progress on development of permanent-type completions for dual zone wells, including those where one zone is pumped.

Negotiations are now pending for the awarding of license on the techniques to service companies is order that the industry as a whole may benefit from the experience already gained.

Ed. McGhee.

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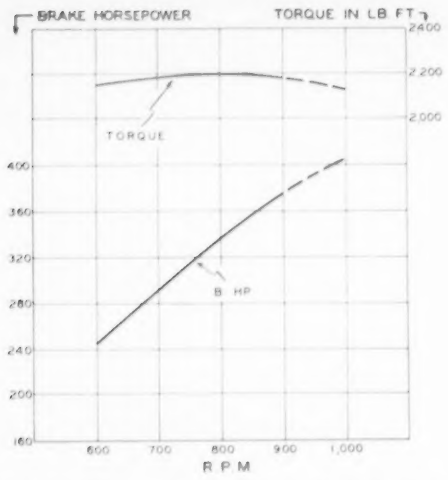

Fig. 1—Performance curve, oil-field internal-combustion engine.

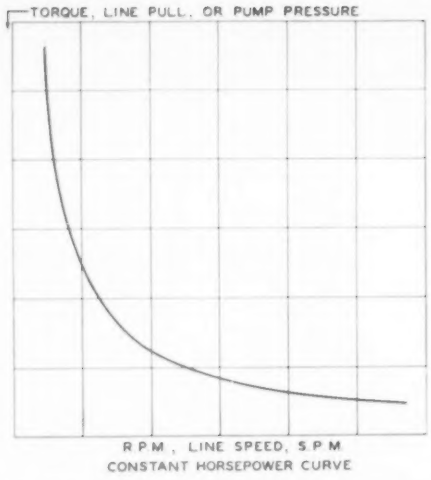

Fig. 2—Constant horsepower curve, plotting torque versus revolutions per minute.

Which Type of Power Transmission on a Rotary

• Friction • fluid • or electromagnetism?

by M. L. Rizzone

WHEN a power-transmission device, such as a fluid coupling, a torque converter, or an eddy-current coupling, is used on the rotary rig, these advantages accrue:

- Shock loads are materially reduced, and increased life in the power train may be expected.
- Torsional vibrations from engine crankshaft are smoothed out.
- Engine cannot be stalled.
- Synchronization of engines within allowable slip range.
- Effect of power train shocks on engine is minimized.

To properly evaluate the requirements of a power transmission, it is well to consider the equipment to be driven and the work to be performed by the transmitting medium. In a rotary drilling rig there are three basic power demands which must be satisfied:

1. Power is required to turn the drill bit and pipe to cut the hole.
2. Power is required to hoist the drill string for removal and replacement of the worn bit.

Author is associated with Oil Well Supply Division, U. S. Steel Corp. Portion of paper presented at the Petroleum Mechanical Engineering Conference, American Society of Mechanical Engineers, Houston, September 28-30.

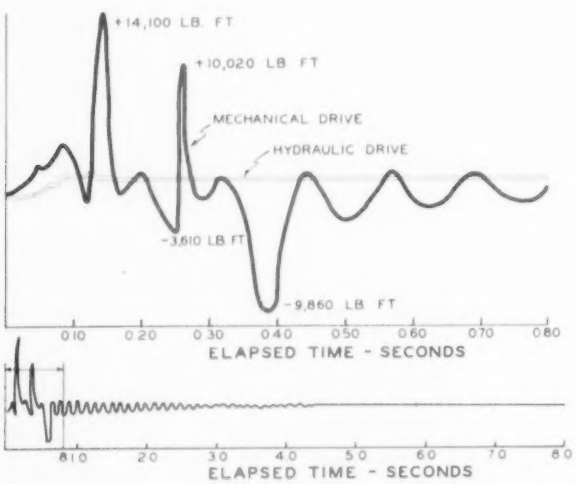

Fig. 3—Illustrating magnitude of momentary loads imposed on power train during engagement of friction clutch.

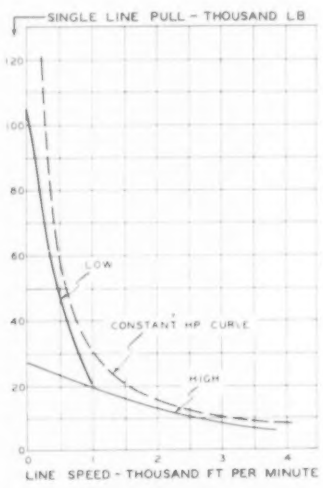

Fig. 4—Draw-works performance curve shows single line pull available over a line speed range with a two-speed drum.

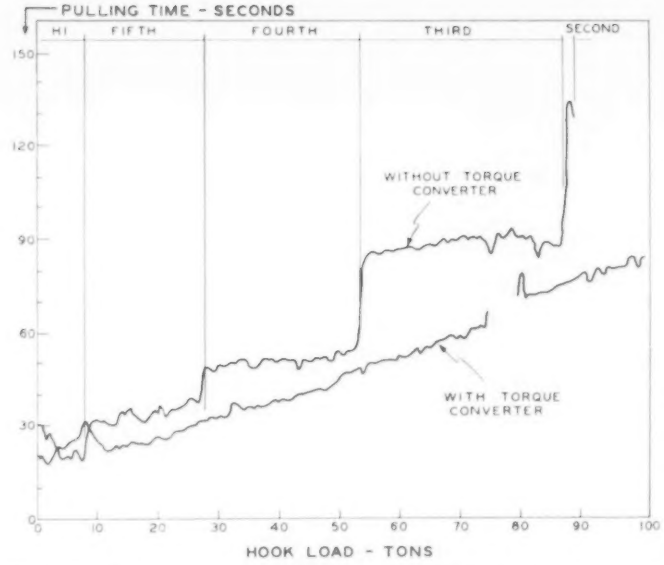

Fig. 5—Illustrating difference in pulling time required on draw works with and without torque converters.

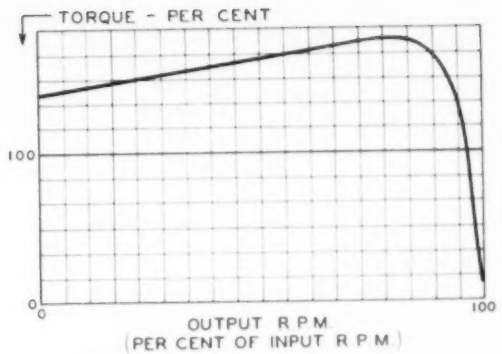

Fig. 6—Performance curve for eddy-current coupling. Close sensitivity is obtainable in its control.

3. Power is required to pump drilling fluid which is necessary to remove the cuttings from the hole, as well as to wash, clean, lubricate and cool the drill bit.

The amount of power required to turn the rotary machine is difficult to evaluate. Approximately 2 hp. per r.p.m. of the rotary table should be provided. Power to turn the rotary machine is usually provided in one of two ways: either it is taken from the power installed on the compound or from an independent prime mover.

The amount of power installed on the compound to drive the draw works is usually in the vicinity of 1 hp. for each 10 ft. of 4½-in. drill pipe. This should permit hoisting a drill string at the rated depth with a velocity of about 100 ft. per minute off bottom. Compounds are generally provided with one or two power takeoffs to drive the drilling pumps. These pumps are usually of the duplex double-acting reciprocating type and are available in various sizes.

In hard-rock drilling less pump horsepower is required than in areas where softer formations are frequent. In the latter areas, large pumps are used to assist substantially in the drilling work, that is, the work required to cut the hole. Operators vary widely in their ideas on pump requirements with applications varying anywhere from 50 to 150 per cent of the required hoisting power.

The amount of power installed on a drilling rig should allow for the driving of auxiliaries such as a generator for the rig-lighting system and an air compressor for the air clutches and controls; however, this is not usually a very appreciable amount and will not concern us greatly here. A maximum of 30 to 40 hp. is generally sufficient.

The Internal-Combustion Engine

It is well to examine a typical performance curve of an oil-field internal combustion engine (one is shown in Fig. 1). It may be quickly noticed that the torque output is fairly constant over the speed range of the engine. As a result the horsepower increases almost proportionately over the speed range. The operation of any internal-combustion engine is limited to a specified speed range and in this case the engine is usually governed at 900 r.p.m. and idles at about 400 r.p.m., therefore, its use must take this into account.

The output torque of the engine is maximum at a point less than the governed speed and when maximum torque is required, the engine slows down to this speed and continues to reduce in speed if the torque demand is too great, causing the engine to lug. This is injurious to any engine and sustained operation under these conditions cannot be permitted. Therefore, when a load is started and an accelerating torque is required, the maximum torque of the engine, multiplied if necessary through a suitable transmission, is available to pick up the load. When the load is in motion the torque demand reduces and the engine comes up to speed delivering maximum horsepower.

When loads are such that a variable torque demand exists during the work cycle, the engine torque must be sufficient to overcome the maximum torque demand, or a transmission capable of varying the delivered torque is required. In a rotary-drilling rig the rotary drive is usually set for some desired rotating speed. The torque value is not a constant and may vary considerably.

When hoisting drill pipe, frequent starts are encountered and a substantial accelerating torque must be available to start the pipe string and other elements from rest and continue the pull at suitable rates of speed. At the same time the load is constantly being reduced as each stand is removed. In the case of driving the mud pumps the requirements of the pump are not constant due to the effect of the crank connecting-rod mechanism.

Constant Horsepower Curve

The basic relationship between horsepower, torque and speed is:

$$\text{Horsepower} = \frac{\text{Torque} \times \text{Speed}}{5{,}250}$$

in which torque is given in pounds-feet and speed in revolutions per minute. It is obvious that the horsepower is the product of torque and speed. For a constant horsepower, torque and speed are so related that an increase in one necessitates a reduction in the other.

When this relationship is plotted (see Fig. 2), the curve is an equilateral hyperbola which is the characteristic curve of the product of two variables maintained constant. This is called the constant horsepower curve. The ordinate or vertical value of the graph is usually torque, or synonymously, line pull or pump pressure. The abscissa or horizontal value is r.p.m., or synonymously, line speed or pump strokes per minute.

In the maximum utilization of the installed power, the prime movers should be used at their rated speed and delivering their rated horsepower. In this manner maximum work is accomplished. Any operating condition or equipment limitation which prevents

maximum utilization raises the net cost of the work performed. It thereupon requires that the design of equipment be such as will yield the practical maximum to the operator.

Thus the internal-combustion engine has a fairly constant output torque through its speed range, and its maximum horsepower is delivered at the highest speed. The engine should then be operated at the highest permissible speed as much as possible. For continuous operation at constant speed, the engine manufacturer will stipulate this speed and will also stipulate what higher speeds may be attained intermittently.

The engine manufacturer will also suggest limits on horsepower demand upon the engine both for continuous and intermittent service. The usual application of engines on a drilling rig requires that they be available for the intermittent hoisting operation as well as for continuous pump and rotary operation. In this case they are governed at a speed which is limited to continuous duty. On very few rigs where the draw works is powered with engines for hoisting only, higher governed speeds are permitted.

The Friction Clutch

The friction clutch has made possible the modern power rig as we know it today. By providing the coupling element between the engine and the driven equipment such as is found on the rotary-drilling rig, it is possible to utilize the internal-combustion engine to pick up loads and transfer power from engine to equipment. It provides the medium which allows the rotating engine, the speed of which cannot be allowed to reduce below a certain amount, to maintain operation and engage a nonrotating deadload and by slippage of the clutch provide a means of transferring torque in an amount sufficient to accelerate the driven equipment. After the driven equipment is brought up to the speed of the engine and no slippage exists, the clutch becomes a coupling in the power train.

When a friction clutch is engaged to pick up a load, a certain amount of shock load is imposed upon the power train. The magnitude of these loads varies more or less directly with the manner of engagement of the clutch. Careless operators can impose very severe loads by sudden clutch engagements. By controlling the air pressure delivered to the clutch with a metering-type control valve or providing a suitable flow restriction choke in the air line to the clutch, the engagement may be made smoothly.

Fig. 3 very strikingly demonstrates the magnitude of the momentary loads that are imposed upon the power train during the engagement of a friction clutch. These are the loads which induce very high stresses in the various members of the power train and the more frequent their occurrence the shorter the wear life of all the component parts. It has been found that the magnitude of these stresses is as much as 10 times the normal operating stress.

The Fluid Coupling

The use of a fluid-drive medium very sharply reduces the magnitude of these shock loads. Two types of hydrokinetic drives are used in the oil field, these being the hydraulic coupling and the hydraulic torque converter. The hydraulic drive dissipates the shock loads over a much longer period of time and with only about three times the normal operating stresses. This very materially increases the wear life of the component parts of the power train.

The fluid coupling is generally placed between the engine and compound shafting. The drive arrangement beyond the coupling is the same as for the mechanical rig and the equipment is operated in much the same manner. The salient advantages to be gained by the use of fluid couplings are:

1. Shock loads are very materially reduced and increased wear life of parts in the power train may be expected.
2. The fluid coupling smoothes out torsional vibrations from the engine crankshaft.
3. The fluid coupling acts as a check to minimize the effect of shocks from the power train to the engine and also the torsional vibrations from the engines to the driven equipment.
4. The engine cannot be stalled.
5. Output torque is always equal to the input torque.
6. Synchronization of engines within allowable slip range.

The torque converter . . . Another form of hydrokinetic drive, which has found wide application on drilling equipment, is the torque converter. The primary difference between the torque converter and the fluid coupling is that the input torque in a torque converter may be multiplied within certain limits, whereas, with the fluid coupling no torque multiplication is possible.

A typical draw-works performance curve is seen in Fig. 4. This chart shows the single line pull available over a line speed range with a two-speed drum. A constant horsepower is plotted and the area between the curves and the constant horsepower curve represents the power loss due to the inefficiency of the torque converter.

The torque converter is ideal for hoisting as it permits a transmission of high accelerating torque to the drum at the start of the pull. As the string is pulled into motion, a lesser amount of torque is required with the result that the string moves faster providing uninterrupted acceleration of the load. The net result of this feature is that during the course of pulling pipe out of the hole with a constantly varying load and with frequent starts, appreciable pulling time may be saved.

Fig. 5 shows the difference of pulling time required on a draw works with and without torque converters. These curves show the actual experience of the same rig with and without converters and the shaded area represents the saved time when using converters.

The torque converter has long been used in the oil field on independent rotary drives. In this application it is extremely difficult to determine the actual power requirements. The torque converter permits the rotary to turn, crowding the drill string, and smoothly overcoming varying torsional resistance.

The application of the torque converter to mud pumps has been questioned at considerable length by both pump manufacturers and operators. However, today this application is quite common and if properly applied the torque can be somewhat advantageous. It permits the engine to function at its most efficient speed range while the pump automatically adjusts itself to the maximum speed it will operate at the limiting pressure constantly crowding the hole with mud. This permits the pump to function through a somewhat broader range of depths with the minimum number of liner changes. Care must, of course, be exercised to insure that the pump is not overloaded which is easily possible with this type of drive.

The prime advantage of the converter application is that it provides a medium such as the fluid coupling which can effectively reduce shock loads. Recently a prolonged study was made of torque converters applied in off-highway heavy-duty trucks in which a comparison of overhaul and maintenance expenses was made between such trucks having standard mechanical transmission and those using converters. This study showed that 47 per cent greater engine life, 400 per cent greater transmission life, and 93 per cent greater differential life was obtained with the converter-equipped trucks.

A similar, but not probably as great, increase in life expectancy is undoubtedly applicable to draw works which are powered through torque converters as high stresses are developed during the hoisting operations. Where hoisting is the predominant function, the use of the torque converter is well justified.

The following additional advantages may be cited for the torque converter:

1. As with the fluid coupling tor-

sional vibrations from the engine crankshaft are smoothed out.

2. The fluid medium acts as a check to reduce the effect of the transferral of peak loads to the engine or equipment.

3. The engine cannot be stalled and at the point of converter stall the engine is pulled down only slightly. The engine, therefore, cannot be lugged.

4. Partial throttle operations are possible throughout the entire speed range of the engine.

The Eddy-Current Coupling

The transmission of power with the eddy-current coupling is gradually finding its place in the oil field. The eddy-current coupling is used much like the fluid coupling as it is generally placed between the engine and the compound.

The eddy-current coupling responds instantly to varying excitation of the coupling field. Therefore, close sensitivity is obtainable in its control. A typical performance curve for this coupling is shown in Fig. 6. The point at which the curve crosses the 100 per cent line is the design point at which the coupling transmits the rated torque. The top point of the curve is the peak torque and the stall torque can be seen to be substanially above the rated torque.

The control may be so arranged that the couplings do not transmit torque until the engines have come to the speed at which they develop maximum torque, thus the engines cannot be loaded at idling speed. This allows the unloaded engines to accelerate quickly. It is also possible by turning a control knob to slow down the hoisting of the drill pipe or hold it at a standstill or even allow it to lower with the engines turning at full speed.

As the eddy-current coupling acts as an untuned damper when transmitting power, no oscillatory or torsional vibrations are transferred. While no equipment life expectancy data are available with the use of eddy current couplings, a definite increase in the wear life may be expected.

Neches Butane Solves Cleaning Problems

(Continued from page 124)

9. Tubes are rerolled if it is necessary.

Furnace operation . . . After the furnace was placed in operation, some difficulties were encountered with its operation in order to obtain the desired cleaning. To control localized burning on the bundles, smothering steam was used but this caused the temperature to go up or down in other parts of the furnace. Finally, after much experimentation with alternate schemes, it was found that by closing the dampers almost tight and reducing excess air there was no difficulty with uncontrolled burning of the bundle or any need for smothering steam.

It had been intended to use the front stack to clean hairpin bundles and the rear stack to clean floating head bundles by mounting adapters so that gas flow would be through the tubes, through the adapter which fastened to the stack breeching on the furnace roof, and out the stacks. Because of restricted gas flow through the tubes, the use of the adapters was discontinued and presently, only the front stack is used. The adapters had also been used to prevent flame impingement on the tubesheets. Since the adapters no longer are being used, a cone shaped permanently mounted impingement plate opposite the flame tunnel opening was installed.

Inside tubes . . . Cleaning of bundles where the fouling is on the inside of the tubes has not been as successful as cleaning outside fouling because of little or no gas flow through the tubes. It was found to be necessary to drill the tubes first so as to be assured of flow through the tubes since gases formed between the plugged ends of a tube will rupture the tube. This is particularly true if plugs, inserted during past downtimes to cut out leaking tubes, are not removed. Also, the practice of rerolling the tubes has been adopted before the bundle is returned to service. To date there has been no difficulty to indicate that subsequent tube roll leaks are due to treatment in the furnace.

As brought out previously, the length of cleaning time is a function of the type and amount of polymer deposited on the tubes. If the deposit is particularly heavy, only two bundles per 5-way week can be cleaned whereas one that is lightly fouled may be cleaned in 24 hours. Calculations show that cleaning bundles in the furnace results in a heat transfer rate of from 90 to 97 per cent of a new bundle. Cost data indicates that bundle cleaning costs have been substantially reduced, and in addition, vastly improved heat transfer rates have been noted. In the 4 years of furnace operation, 256 bundles have been cleaned with some bundles having been cleaned as many as eight times. With all factors taken into consideration it is felt that the installation of the furnace has been justified.

Acknowledgment

This article reports the studies and findings obtained in connection with the operation of a butadiene plant in the government synthetic-rubber program which is operated by the Reconstruction Finance Corp., Office of Synthetic Rubber.

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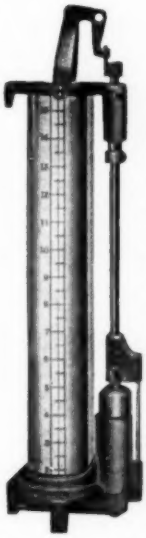

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Other exclusive features include: a rotating valve seat to assure proper seating; encased springs to prevent fouling; trip mechanism which accommodates any length trip rod. Sturdily built for longer service. Available in five sizes: 12, 16, 18, 24 and 36 inches. Available through all supply stores.

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Water flood of Brundred Oil Corp. being viewed by 300 members Kansas-Oklahoma Water Flood Association on annual tour (see Journal issue of July 13, 1953, pages 77-78, for news story). U. S. Bureau of Mines' station wagon in foreground carries public-address system. In group are D. B. Taliaferro, head of secondary-recovery department, USBM, Bartlesville, and coauthors of this article (Powell and Eakin, also USBM).

The 25,000-bbl. settling basin. Into pond goes fresh-water supply plus produced salt water, after mixing with dry lime and alum via proportional feeders. Copper sulfate or sodium hypochlorite is added periodically, to control bacteria growth. Basin is divided by baffles; retention time is adequate to permit complete coagulation and settling. The water is then pumped through pressure filters filled with crushed coal.

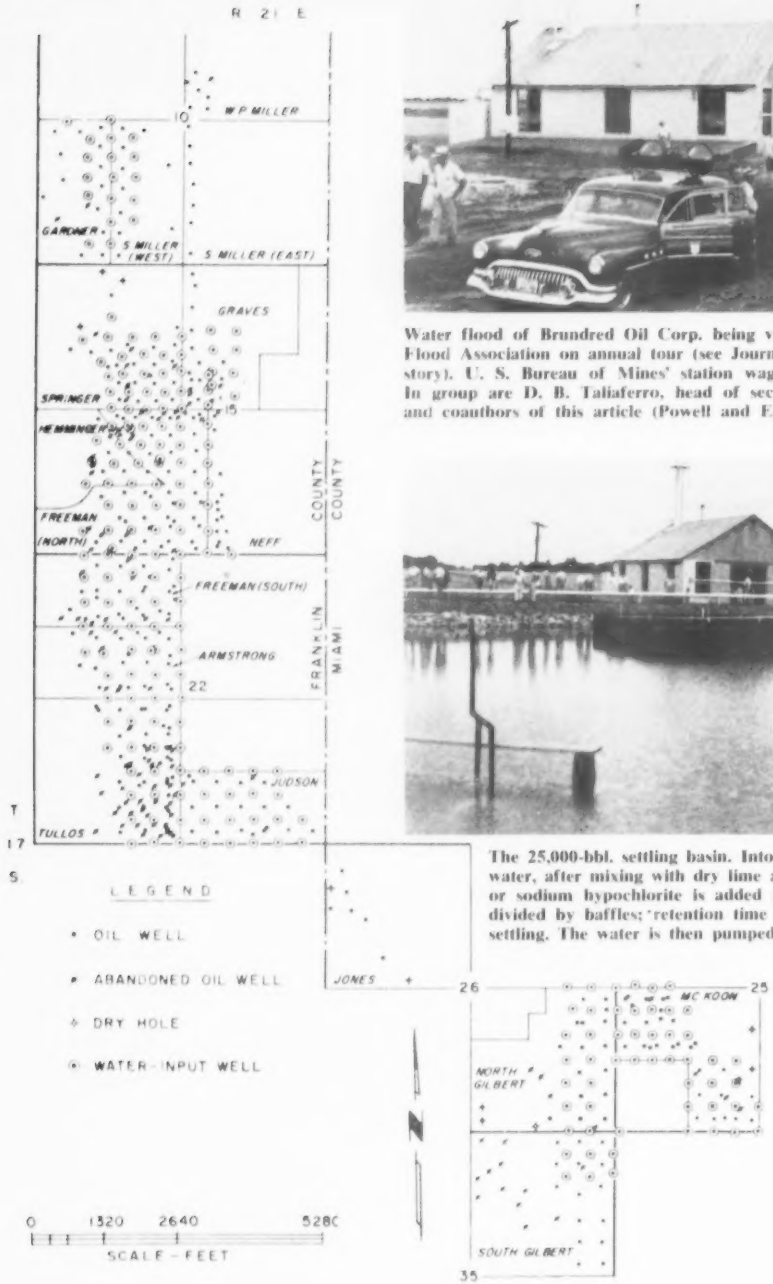

Fig. 1—Map of Brundred Oil Corp. Rantoul project, Franklin and Miami counties, Kansas, January 1, 1953.

Brundred's Rantoul Water Flood Recovers More Than Million Barrels of Oil

by J. P. Powell* and J. L. Eakin*

APPROXIMATELY 1,050,000 bbl. of oil, equivalent to 1,511 bbl. per acre, has been recovered by water flooding on the Rantoul project of Brundred Oil Corp. in Miami and Franklin counties, Kansas. Water injection has amounted to 16.5 million barrels.

It appears probable that average recovery by water injection will approach 2,000 bbl. per acre.

Operations start . . . Brundred began water flooding its group of leases in 10, 15, 22, 25, 26, and 35-17s-21e,

*Petroleum engineers, U. S. Bureau of Mines, Petroleum Experiment Station, Bartlesville, Okla.; data from U.S.B.M. R.I. 4991.

Paola-Rantoul field, in September 1943. These leases lie along the Marais des Cygnes River, and are serviced by a single water plant. Although the project is subdivided into several units for better control, they are considered as one project in this article and identified as the Rantoul project. See Fig. 1.

The water plant was constructed in 1943, and water injection was begun in 3 wells; however, by the end of the following year 59 wells were receiving water on the several leases. The project was expanded annually, and by 1950 about 700 acres was under flood—most of the floodable acres in the leases involved.

The Squirrel sand at a depth of 488 ft. is the principal sand being flooded. Neither the Peru sand at 334 ft. nor the Bartlesville sand at 546 ft. is continuous in this area, although some oil has been produced by water-flooding these sands. The Squirrel sand averages 25 ft. in thickness.

SUMMARY OF OPERATIONS
(Brundred Oil Corp. Rantoul project)

Location	10, 15, 22, 25, 26, and 35-17s-21e
Sands flooded—Peru, Squirrel, and Bartlesville	
Top of sands, ft.—335, 488, and	546
Sand thickness, ft.—15, 25, and	8
Productive area, acres	695
Area flooded, acres	695
Well pattern—five-spot, ft.	330 by 330
Kind of water—Fresh and	produced
Type of system	Open
First injection	Sept. 1943
First increase	Oct. 1943
Gravity 31° to 33°	A.P.I.

OIL PRODUCED AND WATER INJECTED, BBL.

	Oil	Water
1943*	17,639	68,152
1944	15,320	413,751
1945	99,288	887,941
1946	142,136	1,491,362
1947	114,722	1,420,556
1948	154,350	1,661,371
1949	147,932	2,228,368
1950	142,097	2,908,449
1951	119,324	2,468,356
1952	97,130	3,058,306

*Water flooding begun.

Input wells serving one sand were completed with 2-in. cement-lined tubing with rag packers set and cemented at the top of the sand; but some of the input wells that penetrated two sands were completed with dual strings of 2-in. tubing and packers, each set at the top of a producing sand.

Later dual-sand wells have been completed with strings of 2-in. tubing set on packers and cemented at the top of the lower producing sand. This string is perforated opposite the upper producing sand, and a string of 1-in. pipe run inside the 2-in. string and set on a pony packer below the perforated section of 2-in. pipe. Water is injected into the lower oil sands through the 1-in. pipe and into the upper sand through the annulus between the 1-in. and 2-in. strings of pipe.

The oil-producing wells have been completed with 2-in. tubing and rag packers set and cemented at the top of the oil sand. Many of these wells were cored to aid in proper packer setting and control of the flood. Some of the first producing wells drilled were completed with dual strings of pipe; but those drilled later were completed with single strings of pipe, with packers and perforations opposite the sand bodies to permit production from both oil sands.

Both input and oil-producing wells are shot with 1 to 2 qt. of solidified nitroglycerin per foot of sand.

A small stream nearby was dammed to provide a supply of water for flooding. The fresh water is pumped from the stream into a small concrete basin (about 5-bbl. capacity) where it is mixed with the produced brine. As the water flows into a large settling basin (25,000 bbl.), dry lime and alum are added by proportional feeders and copper sulfate or sodium hypochlorite is added periodically to control the

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The Axelson Hydraulic Long Stroke Pumping Unit has 50,000* lb. load capacity and up to 350 fpm polished rod travel.

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*Operation of Unit limited to either 30,000 lbs. polished rod load capacity or 14,000 lbs. load range.

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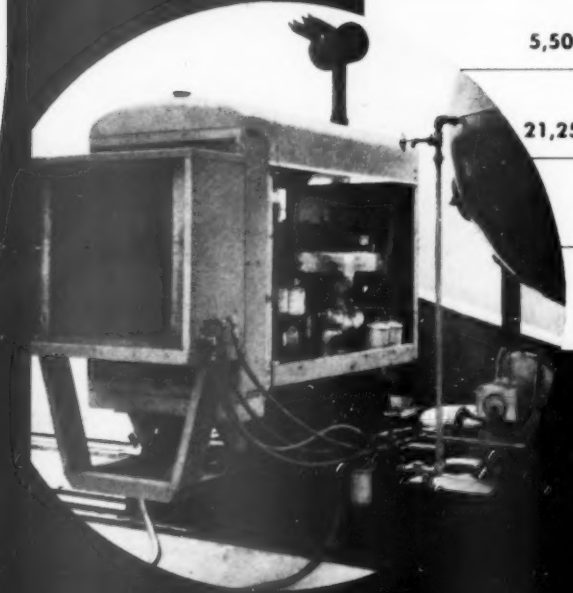
UNIT	84" BEAM UNIT	HEAVY DUTY AXELSON HYDRAULIC LONG STROKE UNIT
PUMP DEPTH	6200 FEET	6200 FEET
TUBING SIZE	2½"	2½"
PUMP BORE	2¼"	1¾"

ROD STRING	SIZE	PERCENT	FOOTAGE	SIZE	PERCENT	FOOTAGE
	1"	28	1760'			
	⅞"	31	1920'	⅞"	33	2030'
	¾"	41	2520'	¾"	67	4170'

STROKES PER MINUTE	17	6½
NET UPWARD PLUNGER TRAVEL PER MIN.	1021½"	1937"
PEAK POLISHED ROD LOAD	26,750 lbs.	15,700 lbs.
MINIMUM LOAD	5,500 lbs.	8,800 lbs.
LOAD RANGE	21,250 lbs.	6,900 lbs.
MAX. SUCKER ROD STRESS	34,100 psi	30,700 psi
PRODUCTION AT 100% VE	595 B/D	690 B/D



Close up of Cooler on H-0313 Model. Cooler maintains hydraulic oil temperature at 165° F. safeguarding against carbon formation and subsequent restriction of movement or breakdown of hydraulic fluid

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SUMMARY OF WATER-FLOOD PERFORMANCE

Date—	Acres flooded	Input wells	Oil wells	Cum. oil prod. (bbl. per acre)	Cum. water-inj. oil-produced ratio
January 1, 1944	8	3	6		
January 1, 1945	110	59	25	300	15
January 1, 1946	151	78	46	870	10
January 1, 1947	210	114	100	1,307	10
January 1, 1948	270	139	130	1,441	11
January 1, 1949	334	160	174	1,627	11
January 1, 1950	437	188	232	1,582	12
January 1, 1951	685	191	246	1,217	13
January 1, 1952	685	194	249	1,391	14
January 1, 1953	695	194	234	1,511	16

	Bbl.
Water injected to January 1, 1953	16,606,612
Oil produced by water flooding to January 1, 1953	1,049,938

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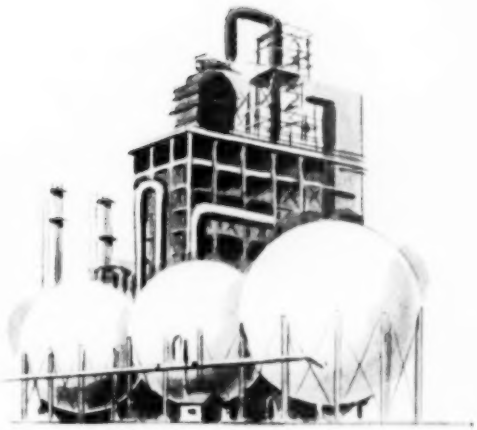
Treated water moves from clear-water tanks to vacuum aerating tower installed at rear of pressure plant building. This vessel removes dissolved oxygen and reduces corrosion. The tower is 30 ft. high by 3 ft. diameter, is filled with ceramic rings. A two-stage vacuum pump applies vacuum of 26-in. mercury. Dissolved oxygen content is reduced from 9.9 to 1.7 p.p.m. The pressure plant is all electric.

growth of bacteria. The basin is divided by baffles and provides enough retention time to permit coagulation and settling.

The brine is then pumped through closed pressure-type filters filled with crushed coal into four 1,000-bbl. clear-water tanks. A vacuum deaerating tower (see photo) between the clear-water tanks and the injection pumps removes most of the dissolved oxygen from the treated water. Three 5 by 8-in. pumps, each belted to a 50-hp. electric motor, force water into the distribution system at a pressure of 600 psi. The water-input rates and pressures are regulated at each wellhead.

In general, good results have been obtained on the Rantoul project by water flood. Some leases have responded better than others; but approximately 1,050,000 bbl. of oil, equivalent to 1,511 bbl. per acre, has been recovered by the injection of 16½ million barrels of water. No attempt has been made to segregate oil production from the several sands; but it is estimated that the oil from the Peru and Bartlesville sands does not amount to more than 5 per cent of the total recovery.

Although the cumulative water injected-oil produced ratio is 16:1, the current annual rate is nearly twice as high. It appears probable, however, that the average recovery by water injection will approach 2,000 bbl. per acre.



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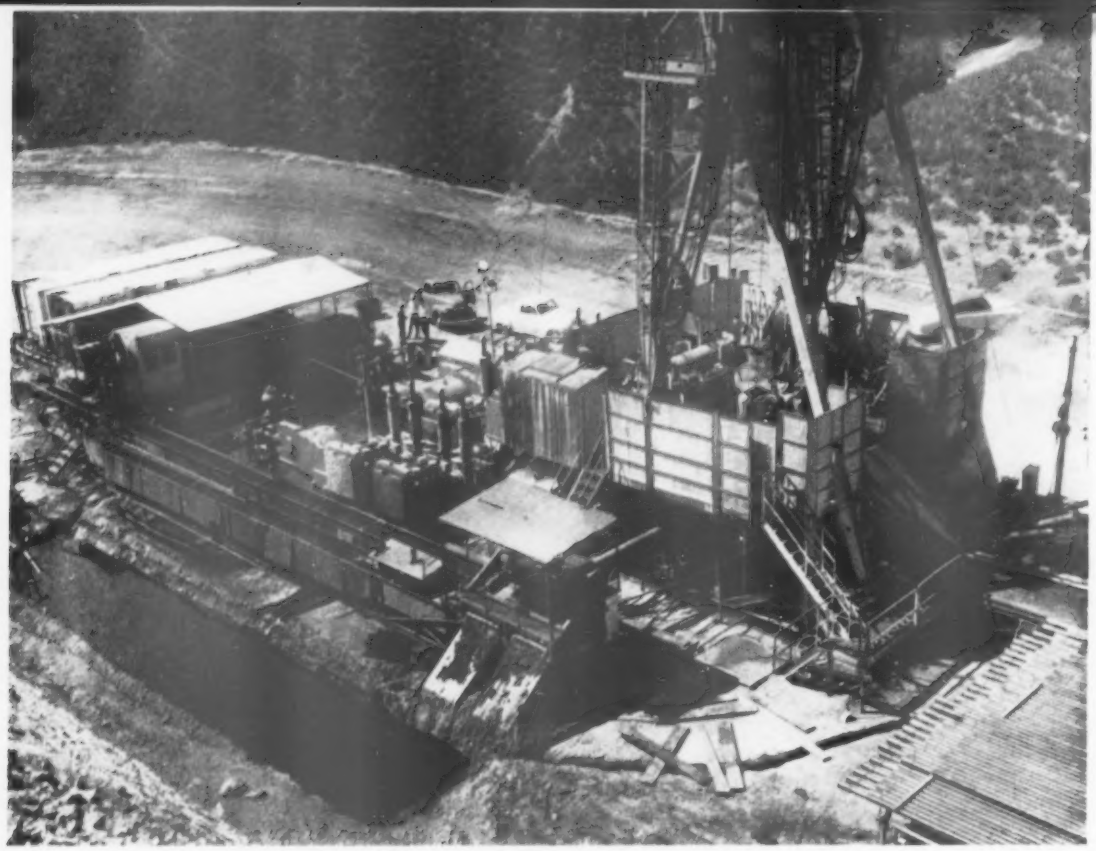
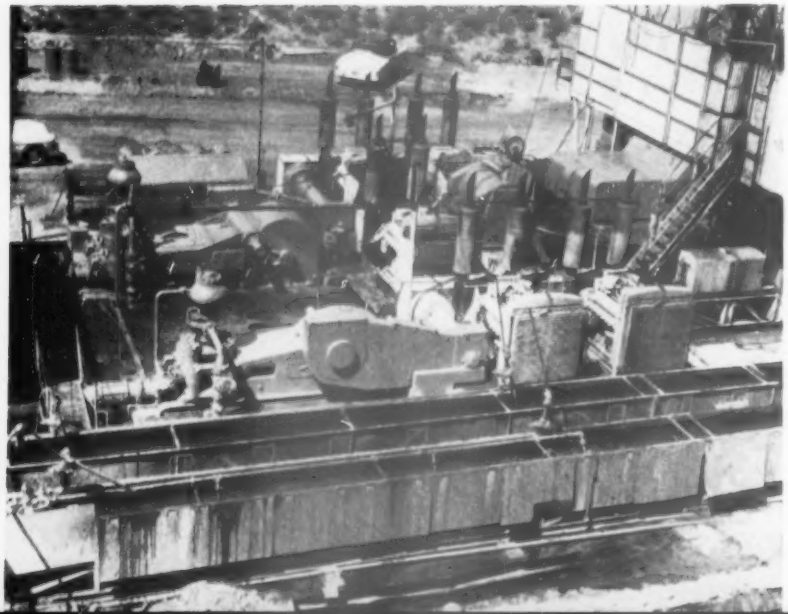


Compact in layout, a minimum number of loads are required in moving the 1,500 hp. rig from location to location. The split-drive arrangement used (bottom of page) permits either of two flank engine units to feed into draw works or either mud pump.

New Shell Rig Is Ventura Pace Setter

First three holes rank among fastest drilled to comparable depths

by D. H. Stormont
West Coast District Editor



A HEAVY rig designed to investigate the upper limit of mud-circulating volumes in jet-bit drilling 12,000 to 15,000-ft. Ventura Avenue wells is proving exceptionally capable of fast drilling and rapid moving.

Placed in operation by Shell Oil Co. last February, in September it was drilling its fourth hole. On none of these did it establish record drilling times. However, the three wells it has completed rank among the fastest drilled to comparable depths. It thus may be classed as a pacesetter in evaluating the performance of contractor-owned rigs, which account for the bulk of Shell's drilling in Ventura Avenue.

Not only was the 1,500-hp. Wilson Titan rig designed from the viewpoint of horsepower available at the draw works, but it was also arranged to per-

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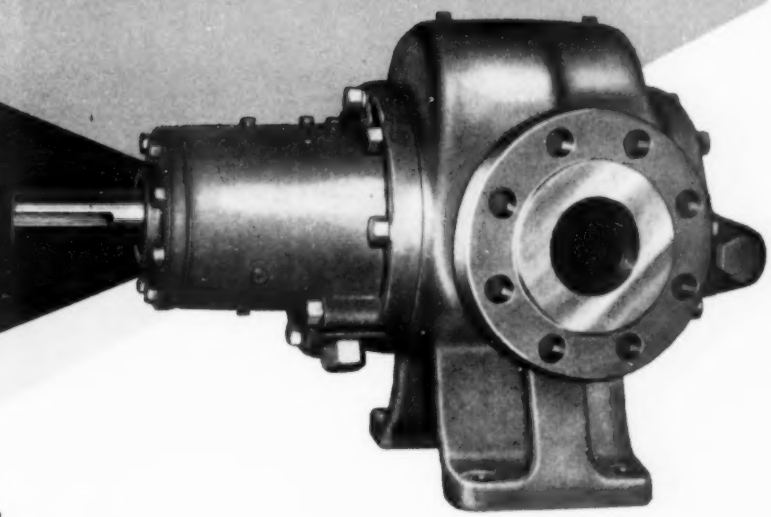

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CAPACITIES
to 800 G.P.M., 5316 B.P.H., 30,145 B.P.D.
DISCHARGE PRESSURE
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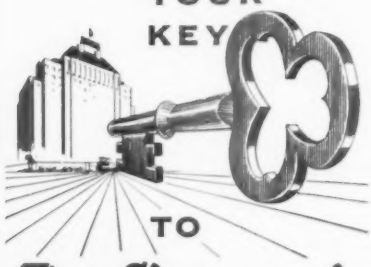

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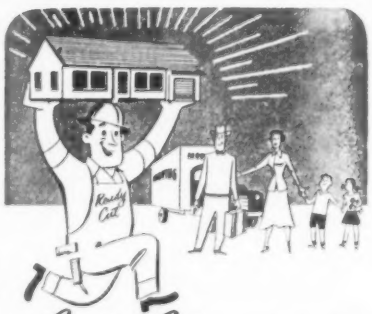

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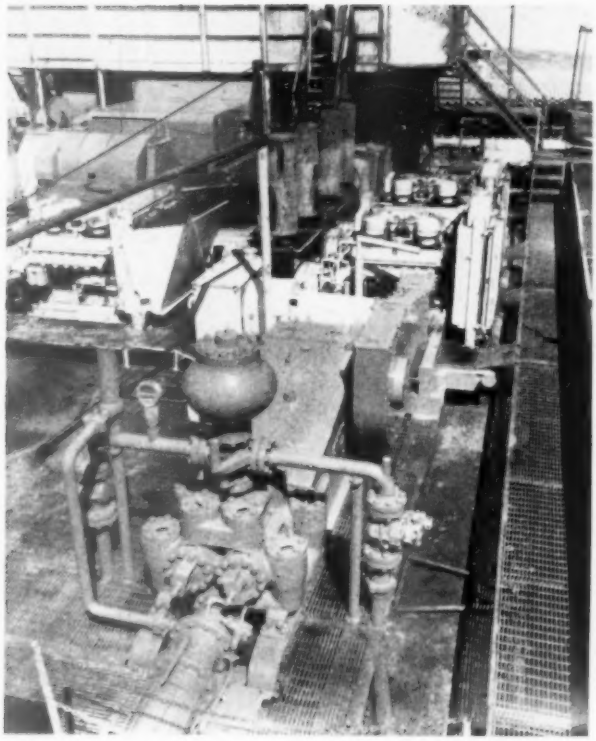
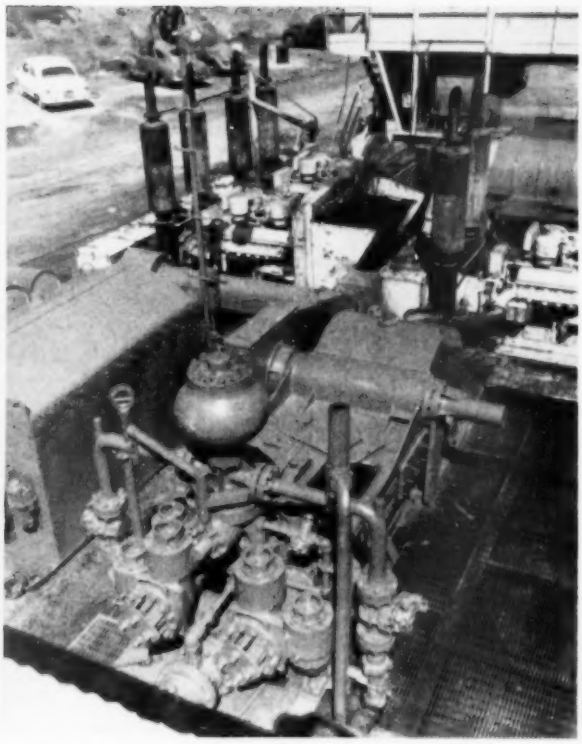


This two-engine and 500-hp. pump is skid mounted to be moved as one package. Alignment between the compound and pump is provided for through use of a universal-joint drive.



Four of the rig's five engines can be applied to this 750 hp. pump, which is driven by a universal joint from the compound of the two engines in its rear.

mit maximum input to the pumps. Specifically, it was designed to maintain jet velocities in excess of 250 ft. per second and an annular rising velocity of more than 150 ft. per minute.

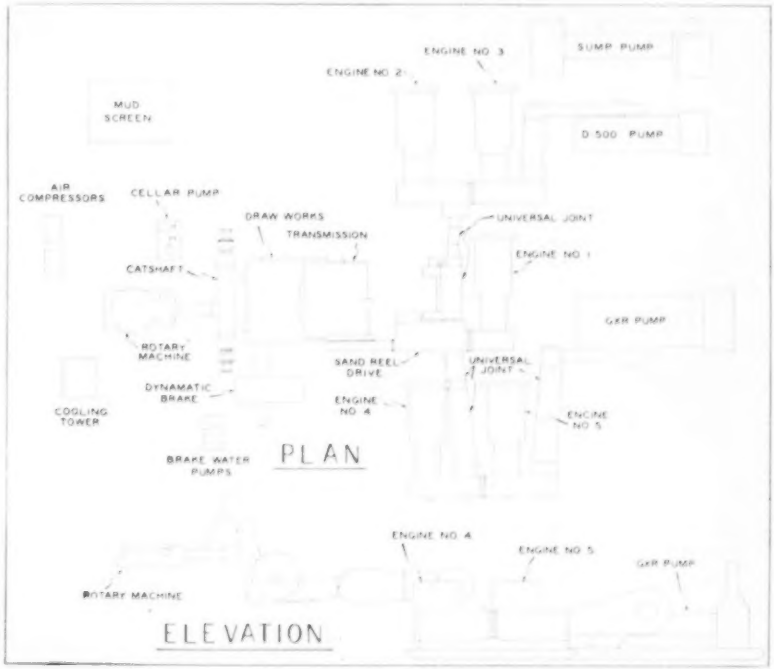
Compared to about a year ago, overall drilling time for deep wells is now 15 or 20 per cent faster; actual drilling time has been reduced by approximately 30 per cent.

This improvement was effected through major changes in above-the-pay drilling practices. Average weight carried on the bit has been raised from around 12,000 or 14,000 lb. to 25,000 or 35,000 lb. Mud volumes circulated have been increased and there has been a substantial increase in applied pump horsepower—in the order of 50 per cent on rigs which have been changed. Whereas rotary speeds of about 200 to 300 r.p.m. were used, they now are in the order of 250 to 350 r.p.m. In some experimental drilling with this new rig, speeds of 400 r.p.m. have been used.

That the rig is one of the fastest, though not the largest, in the field is evidenced by the fact that its first three holes rank among the fastest drilled in Ventura Avenue.

That the unitization features incorporated make for rapid moving is illustrated by the fact that its moving cost is about 25 per cent less than the average cost for Ventura Avenue heavy rigs. Moving time from location to location—from tear-out to spudding-in time—averages about five 8-hour days.

The rig's split-drive design makes for extreme flexibility in application of power. All of the five gas engines, rated at 425 hp. at 1,800 r.p.m., may be used for hoisting. Any of four engines can be applied to either of two pumps. Such an arrangement, of



Plan and elevation views of how the power units are arranged to achieve maximum flexibilty

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▸Available in both Double (illustrated) and Single designs to provide maximum flexibility for various well requirements. Even in sizes as large as 13⅜" (12" Series 900) the Double Gate provides *two* ram compartments in an overall height of only 30". Smaller sizes require even less space!

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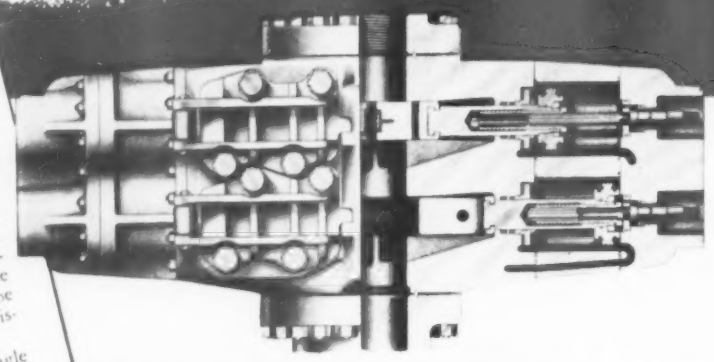

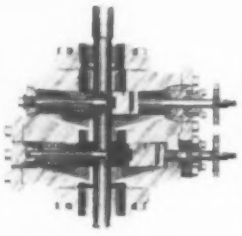

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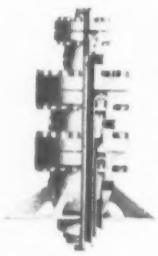
▸Available in two types—Type 50 for general drilling operations, even through 10¾" casing and larger . . . and Type 51 for slim hole drilling, production and re-work jobs.

▸Both maintain a continuous seal around the various diameters and shapes in the drill string—round, square or hexagonal—whether string is rotating, being raised or lowered, or is stationary.

Nothing else combines the simplicity and safety of this equipment for pressure control while the drill string is in the well.



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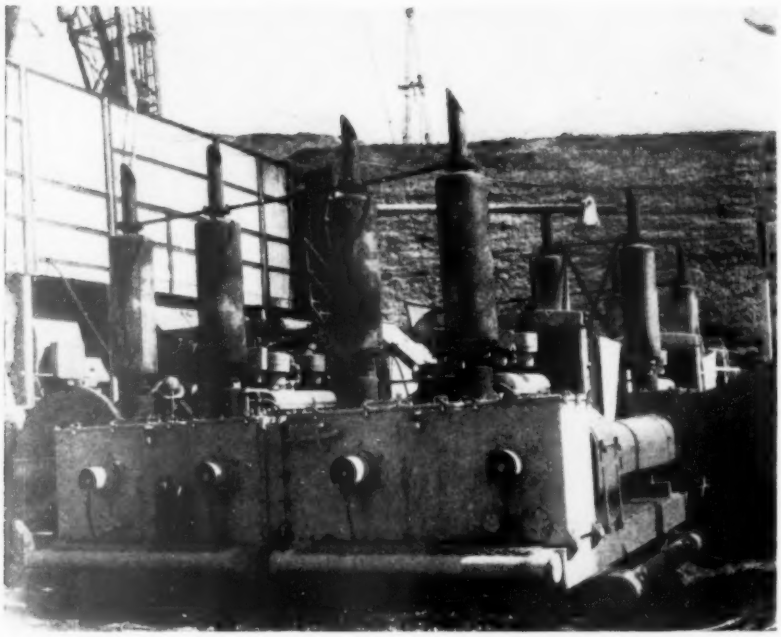

Compound end of one two-engine power unit, which can either drive the 750-hp. pump through the universal joint or feed into the main driveshaft through a second propeller shaft.

course, tends to minimize down time as any engine can take over the normal duty of another when it requires repairing. Likewise there is no idle horsepower; all engines are working whether drilling or hoisting.

Minimum loads . . . The rig was designed so that it can be moved from location to location in a minimum number of loads, all of which can be readily broken down into legal-size packages when moved over public highways. Likewise, it can readily be rigged up or torn down. In regard to the latter, only two chain drives need be broken for a move. All other drives between packages are universal joints, which can be connected or broken out in a very few minutes.

The split-drive arrangement of the rig is carried out at two levels, as shown in the accompanying elevation diagram. The pumps are on ground level, as are the torque-converter-equipped engines and compounds. The selective-speed transmission and draw works are mounted on a 4-ft. base; only major piece of equipment at derrick-floor level is the cathead works. This arrangement, with all heavy equipment at or near ground level, likewise makes for easy, rapid rigging up.

Unitized . . . These components of the rig are unitized and moved as five 40,000 to 70,000-lb. loads. They are: (1) Engine No. 1, the sand reel, and main driveshaft for receiving power from the four flank engines; (2) engines 2 and 3, their compound, and a 500-hp. auxiliary mud pump, comprising a 70,000-lb. load; (3) engines 4 and 5 and their compound; (4) a 750-hp. pump, which comprises a 55,000-lb. load; (5) the draw works and selective transmission.

Remainder of the rig breaks down into nine heavy-truck or trailer loads. These are: (1) the 143-ft. mast; (2) and (3) the unitized, box-type mast substructures; (4) catworks and rotary-table drive skid; (5) unitized mud pit, chemical tank, and manifold; (6) and (7) shale shaker and unitized two-section double mud ditches; (8) and (9) two mud-storage tanks.

Each of the Hall-Scott V-12 engines is independently mounted on 10-in.-wide flanged beams, arranged so they can be bolted directly to the skids of the engine compound. Each drives through a Torcon torque converter and is coupled to the compound through air-tube disk clutches. Engine alignment is maintained by tapered dowels.

In place of conventional chain or belt drives, universal joints connect the two output shafts of the two-engine compound units to their primary mud pumps and to the main drive shaft.

Transmission Drive

As earlier described, the transmission is unitized with the draw works into a single skid which rests on a base at truck-height level. With the draw works and connecting dynamatic brake thus "submerged," only the cathead and rotary drive unit are at derrick-floor level.

Also on the derrick floor is a movable driller's console, from which engine throttles, clutches and drives, speed changes, and brakes are all remotely controlled. Air-tube disk clutches in the drum, transmission, engine, and pump drive clutches all are fully air operated by the driller from this control panel. Remote controls also operate the spinning and breakout catheads, as well as the air-operated slips.

For hoisting, the power output of the two-engine compounds is made available to the selective speed transmission by means of chain drives from the main driveshaft. The fifth engine, which is used only for hoisting and driving the rotary and cathead works, drives over the main driveshaft into the transmission. Any of the four outside engines thus can take over the duty of engine No. 1, and all five can be applied for hoisting.

Mud Circulation

Since the rig was designed from the hydraulic viewpoint, special thought was devoted to sizing and streamlining of the mud system. The pumps take suction from the pit through 10 and 12-in. mud lines unitized to the tank. From the pumps mud goes directly to the 5½-in. mud line and standpipe, to which is attached a 3½-in. i.d. rotary hose.

In drilling to the casing point at about 11,000 ft., 5-in. o.d. 19.5-lb. drill pipe is used to cut a 10⅝-in. hole. A high-pH lime mud weighing about 80 lb. per cu. ft. is normally used in this drilling. For drilling through the pay zone, 3½-in. drill pipe is used. An oil-base mud weighing between 80 and 130 lb. is used in this work.

Mud circulation is maintained by a 7¾ by 18-in., 750-hp. Gardner-Denver or an Emsco 500-hp. pump, into either of which all four engines can feed if desired. While all four are applied to the larger pump, only three are used on the 500-hp. pump. This is believed to be the first application of 1,000-hp. input to a mud pump through a universal-joint drive.

To supply the large volume, high-pressure mud circulation needed for jet-bit drilling, the pumps are operated at 70 to 80 s.p.m. in up-the-hole drilling and at 65 to 75 s.p.m. for bottom-hole drilling. Volume of mud circulated varies from about 750 g.p.m. at a discharge pressure of approximately 1,600 psi., to 600 g.p.m. per minute at 2,100 psi. in drilling the lower portion of the hole.

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SPECIFIC SPEED, CENTRIFUGAL COMPRESSORS—4

Impellers for Pipe-Line Application

by Harold Woodhouse

ALTHOUGH the impellers under discussion in this series have vanes which are composed of a series of radial elements, the actual relative discharge angle of the flow from the impeller may vary from close to 90° for one having a contour similar to Fig. 1, down to 65° for one having a contour similar to Fig. 2. This relative discharge angle is also influenced by variations in the value of angle Θ in Fig. 3, which is a sectional development along an inlet eye diameter as shown at A—A in Fig. 2.

With angle Θ in the order of 60° the relative discharge angle β_2 might be as low as 67°. For pipe-line designs, however, β_2 probably would be in the range of 80°-85°.

Machined impeller . . . It will be seen that, compared with cast, forged, or fabricated impellers having backward-curved vanes with β_2 in the range of 40°-60°, the machined impeller with its β_2 values of 65°-85° will develop a head comparable to impellers with radial discharge vanes since in the equation for the theoretical head[1] expressed in the form:

$$H = \frac{1}{g} U_2^2 \times \left(1 - \frac{Cr_2}{U_2 \tan \beta_2}\right) \quad (1)$$

Where Cr_2 = absolute radial discharge velocity of gas.

The component $\frac{Cr_2}{U_2 \tan \beta_2}$ will be zero for $\beta_2 = 90°$ and very small for the stated range of β_2. In other words, the delivered head will always be nearly equal to that obtained from a conventional impeller with straight radial vanes.

On the other hand, for the typical cast, forged, or fabricated impeller, which has β_2 values of 40°-60°, the component

$$\frac{Cr_2}{U_2 \tan \beta_2}$$

will not be negligible and will result in a sizable reduction in available head.

For this reason, in selecting an average value of the pressure coefficient K, which was fixed at 0.53 for the previous types, allowance will be made for its generally higher value in practice. In the present specific-speed calculations a conservative value of 0.595 has been selected although 0.66 would not be unusual on test.

In addition, although their use has been restricted to the 500-ft. per second tip speed range in pipe-line use, their construction capabilities are such that 1,200 ft. per second is quite feasible, particularly since no high temperature is involved. So, a conservative upper limit of 1,000 ft. per second is here selected as the maximum value of U_2.

With these assumptions the limitations in the specific speeds of the machined type have been worked out and superimposed on the chart worked out in Fig. 2, Installment No. 3 of this series, for the other types.

Some conclusions . . . The completely radial form of impeller has a very restricted range of specific-speed application.

Within the conservative limitations of present pipe-line practice which results in the use of relatively low speeds, the entire pipe-line range is probably covered by the use of radial and cast, forged, or fabricated Francis impellers or radial and integrally machined impellers.

Use of the integrally machined impeller is, however, entirely predicated on the availability of milling-machine vane generating equipment.

Author is chief engineer, Dean Hill Pump Co.

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1. Centrifugal Pumps and Blowers, Austin H. Church, Wiley & Co., New York, First Edition 1944, pp. 49-67.
2. Centrifugal and Axial Flow Pumps, A. J. Stepanoff, Wiley & Co., New York, First Edition 1948.
3. Turbo Blowers and Compressors, W. J. Kearton, Pitman & Co., New York, First Edition 1926.

Fig. 1—Relative discharge angle of flow is close to 90° for this impeller contour.

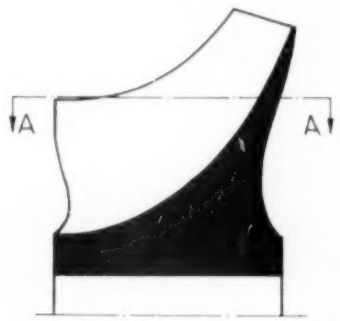

Fig. 2—For this impeller contour relative discharge angle of flow is 65°.

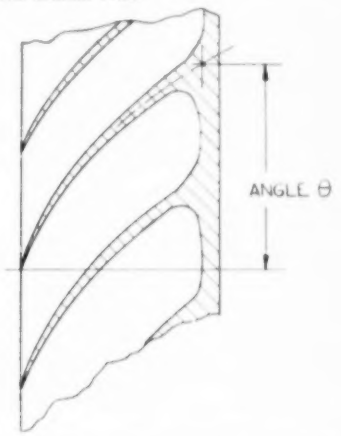

Fig. 3—Sectional development along an inlet eye diameter as shown at A-A in Fig. 2.

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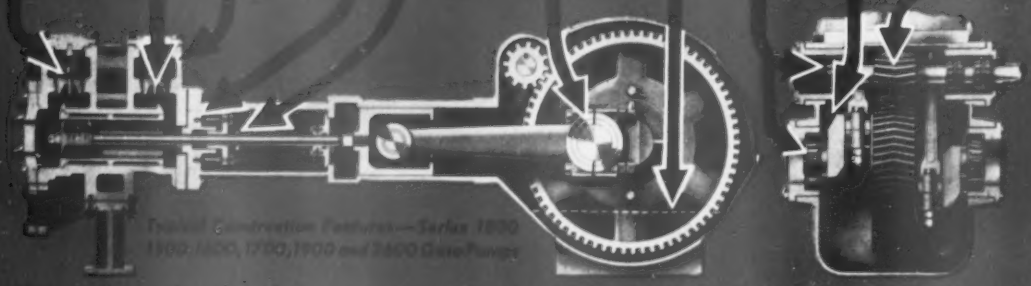

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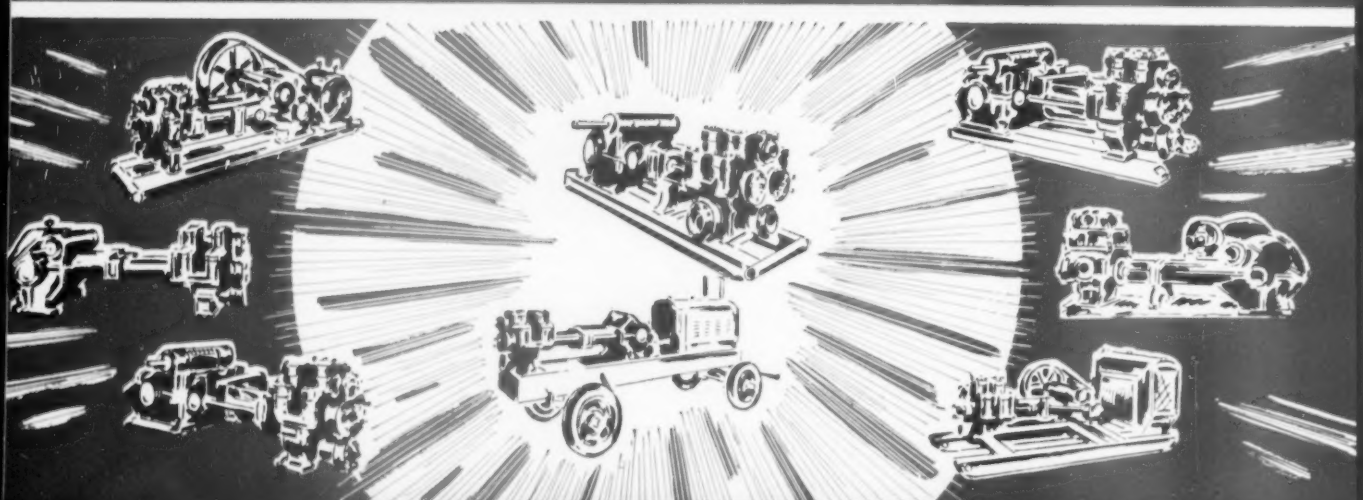

A New Valve Design Concept

by C. F. Woods*

FIG. 1 shows the plug design for a 14-in. valve that handles pressure drops of 550 psi. with rock-like stability with only 18 psi. on the 192 sq. in. diaphram, and has a 75 per cent travel speed of 3 inches in 3.2 seconds flat, under load conditions. Control response is at least as fast as the process reaction rate, and even though it has a linear plug, it is furnishing stable recovery without cycling on major upsets and straight line control thereafter.

The plug for this valve is a simple contoured disc with linear flow-lift characteristics, essentially fully balanced, and provided with center guiding—at the point of maximum thrust. It has approximately ⅓ less pressure drop than the conventional percentage plug at open flow.

In the globe body design incoming flow is directed around the dividing web. The hemispherical shape of the bonnet and bottom cap offer peripheral distribution, rather than spotted or tangential impingement. Notice Fig. 2 which shows a plan view of the body. Here again may be observed the fully developed hemisphere which allows full peripheral distribution of incoming flow.

The area difference of the two plugs is 0.100 sq. in. This, added to the area of the stem, represents a total area of 1.327 sq. in. of static unbalance. Dynamic unbalanced vertical stem forces are surprisingly small, and are always in one direction—upward—tending to aid the spring force in closing the valve, and keeping the stem in compression. The forces increase with mass velocity with no reversal of direction.

The small static unbalanced forces are additive to the dynamic forces. Torsional forces are apparently low. We know, within reason, that turbulence is slight. Presumably, the center guides give an extra-value advantage, by serving as directional vanes. The diaphram motor has a 3 to 15 psi. spring range, and is equipped with a valve positioner with a low capacity pilot, which operates a high capacity speed booster relay. Both units are supplied with separate air regulators of adequate capacity, set at 30 psig. output. Air consumption is very small when the valve position is stationary. A small needle valve is installed in a bypass line around the booster relay. This connection serves as a feed back, giving a rate action effect, and "cushions" the starting and stopping of the valve, so that overshoot is completely eliminated, cycling is absent, with complete stability and high sensitivity of positioning.

Instrument controlled travel speeds, under load, are:

Closing (exhausting air)—		
1-in.	1.1 Sec.	75% open
Second inch	1.1 Sec.	50% open
Third inch	1.0 Sec.	25% open
Opening (Supplying Air)—		
1-in.	1.8 Sec.	50% open
Second inch	1.6 Sec.	75% open
Third inch	1.7 Sec.	100% open

Figures 3 and 4 shows actual effective flow and pressure control characteristics of this valve from field test data. Reference to Figs. 2 and 3 of Installment No. 2 of this series indicate the similarity of its actual effective curve to the design curve.

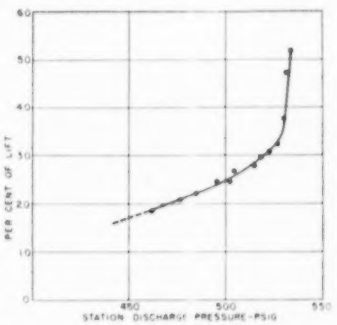

Fig. 4—Actual effective valve pressure control characteristics.

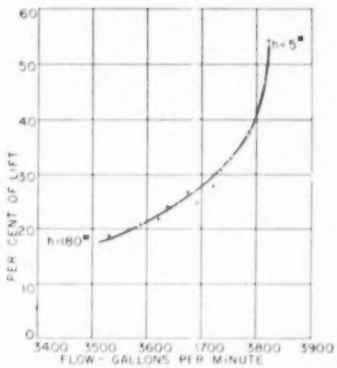

Fig. 3—Actual effective valve flow characteristics.

Fig. 1—New plug design for a 14-in. valve.

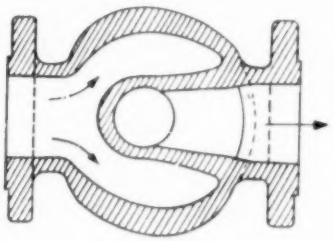

Fig. 2—Plan view of valve body shows fully developed hemisphere.

*Minneapolis-Honeywell Regulator Co., Dallas. Portion of paper presented at A.S.M.E. Kansas City meeting.

OCECO
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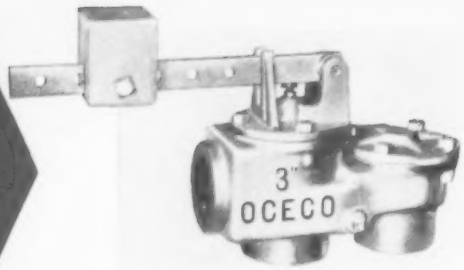
Still Type
VALVES



● These valves combine both vacuum relief and pressure relief in a single body and avoid the necessity of using two separate valves when both vacuum relief and pressure relief are desired. 3 inch, 4 inch and 6 inch sizes. Steel bodies. Bronze, stainless steel or aluminum trim. Can be furnished with vacuum relief settings from 1 oz. to 10 oz. per square inch. Pressure relief settings from 2 lbs. to 25 lbs. per square inch. For temperatures up to 650° F.— working pressures up to 30 lbs. per square inch. Write for fully descriptive data sheet.

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Engineering Fundamentals

We credit our sources . . . Proper credit for several figures used with the current series on Electric Logging has inadvertently been omitted. The following figures were taken from **Electric Well Logging,** a copyrighted manual by Hubert Guyod, president of Well Instrument Development Co., Houston:

Fig. 1, Electric Logging—6, The Oil and Gas Journal, issue of July 27, 1953.

Fig. 1, Electric Logging—7, The Oil and Gas Journal, issue of August 10, 1953.

Fig. 2—Electric Logging—8, The Oil and Gas Journal, issue of August 17, 1953.

Figs. A, B, C, D, E, F, Electric Logging—9, The Oil and Gas Journal, issue of August 24, 1953.

Fig. 1, Electric Logging—10, The Oil and Gas Journal, issue of September 14, 1953.

Figs. 1, 2, 3, and 4, opposite page, Electric Logging—11, were also taken from **Electric Well Logging.**

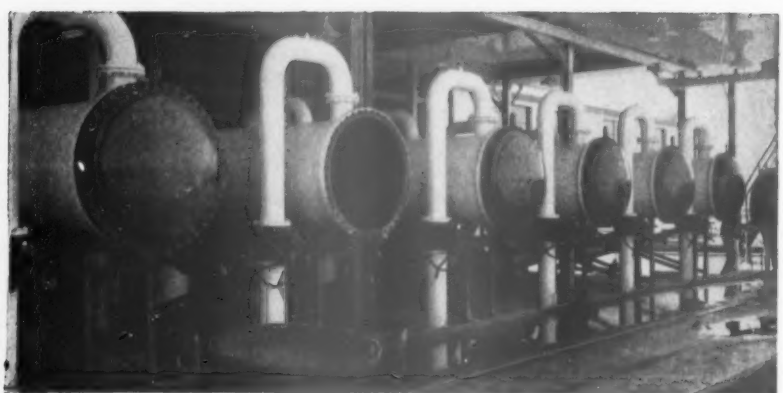
BOOKS

SYMPOSIUM ON STRENGTH AND DUCTILITY OF METALS AT ELEVATED TEMPERATURES. Published by American Society for Testing Materials, 1916 Race Street, Philadelphia. 256 pp. $3.25.

The papers and discussions in this symposium, sponsored by the Joint A.S.T.M.-A.S.M.E. Committee on Effect of Temperature on the Properties of Metals, were presented at the 1952 annual meeting of the A.S.T.M. The material concerns the effects of notches on metals at elevated temperatures, under either static or dynamic loading, and discusses results of current research on the subject. It also discusses the metallurgical changes which occur during heating at elevated temperatures, and the effects of these on strength and ductility.

GASIFICATION OF HYDROCARBONS. By Dr. Jerome K. Morgan. Published by Moore Publishing Co., 48 West Thirty-Eighth Street, New York 18. 180 pp. $4.75.

This volume treats the problem of maintaining an adequate uninterrupted flow of gas to more than 26 million present customers, as well as to the additional millions of new customers anticipated in the next half dozen years. The book is timely because (1) old and new natural-gas and mixed-gas companies are finding it increasingly difficult to maintain continuous service to the soaring numbers of home-heating customers and to industrial customers eager for a firm supply, (2) the cost of building pipe lines has increased greatly, and (3) underground storage of natural gas near points of gas consumption is not always feasible. The answer, the author feels, is for gas utilities to build auxiliary production facilities for peak shaving and emergency standby. The book is liberally illustrated with charts, tables, diagrams, and maps.



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ELECTRIC LOGGING—11

How Apparent Resistivity Varies

by R. I. Martin*

BECAUSE the two-electrode curve is so sensitive to changes in hole size and bed thickness it is worth while to investigate further. Fig. 1 shows a summary of the effects displayed in Figs. A through F of Installment 9. Electrode spacing and hole diameter are held constant. Apparent resistivity is plotted against relative thickness of the beds.

In order to study the effects of changing the spacing while holding the bed thickness constant, Fig. 1 may be replotted as in Fig. 2 with the abscissas inverted to give the relative spacing (S/t). This results in a curve which is the mirror image of Fig. 1. In the former case, however, both hole diameter and electrode spacing were held constant. Now that the electrode spacing has been allowed to vary, it follows that the hole diameter will have to change proportionally with the electrode spacing. This is not a very practical result so that the application of Fig. 2 is not general. When the electrode spacing is large in relation to the hole diameter, however, the effects of hole diameter are not important. For this reason the right-hand portion of Fig. 2 may be used in a qualitative manner.

In order to investigate the region where the spacing is appreciably less than the bed thickness, a resistivity profile may be deduced as shown in Fig. 3. When the spacing is small, for example, less than one-tenth of the hole diameter, the resistivity measured will be little different from the mud resistivity. For long spacings, more than 20 times the hole diameter, and when the bed thickness is several times the spacing, the apparent resistivity will approach the true resistivity. This condition is not fulfilled in practice when normal devices are used so that the right portion of Fig. 3 is not very useful.

The relevant parts of Figs. 2 and 3 are combined in Fig. 4 to show in a qualitative manner the variation in apparent resistivity when a bed of constant thickness, penetrated by a bore hole of constant diameter, is logged with a variable electrode spacing.

If the electrode spacing is small the apparent resistivity is unduly influenced by the drilling mud. As the electrode spacing is increased the apparent resistivity increases until the spacing approaches the critical thickness. When this happens the apparent resistivity decreases and reaches a minimum at the critical thickness. As the spacing is increased further, a small increase in apparent resistivity takes place.

*Assistant professor of petroleum engineering, Missouri School of Mines and Metallurgy.

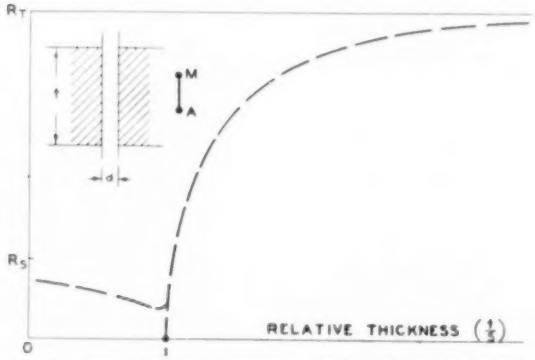


Fig. 1—Curve showing a summary of the effects displayed in Figs. A through F in Installment 9 when there is variable bed thickness.

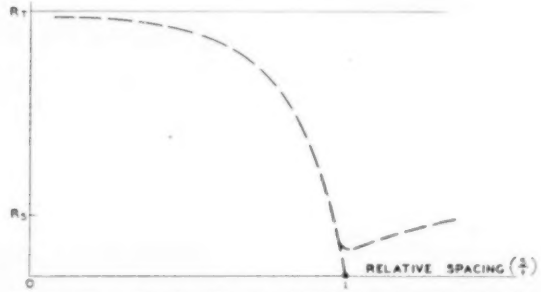


Fig. 2—Curve showing Fig. 1 replotted in order to study the effects of changing the spacing while holding the bed thickness constant.

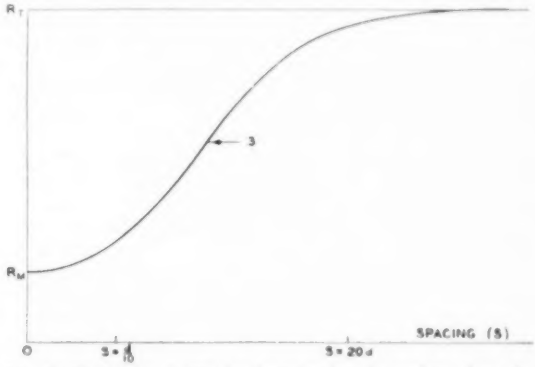


Fig. 3—Resistivity profile for investigating the region where the spacing is appreciably less than the bed thickness. Shows effects of drilling fluid.

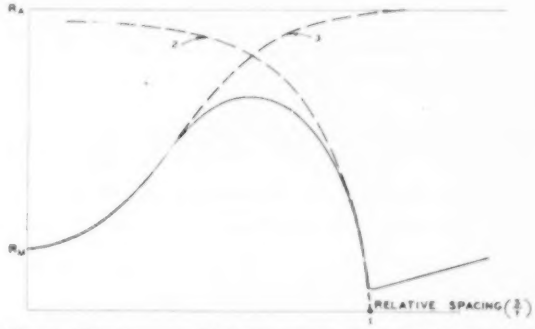
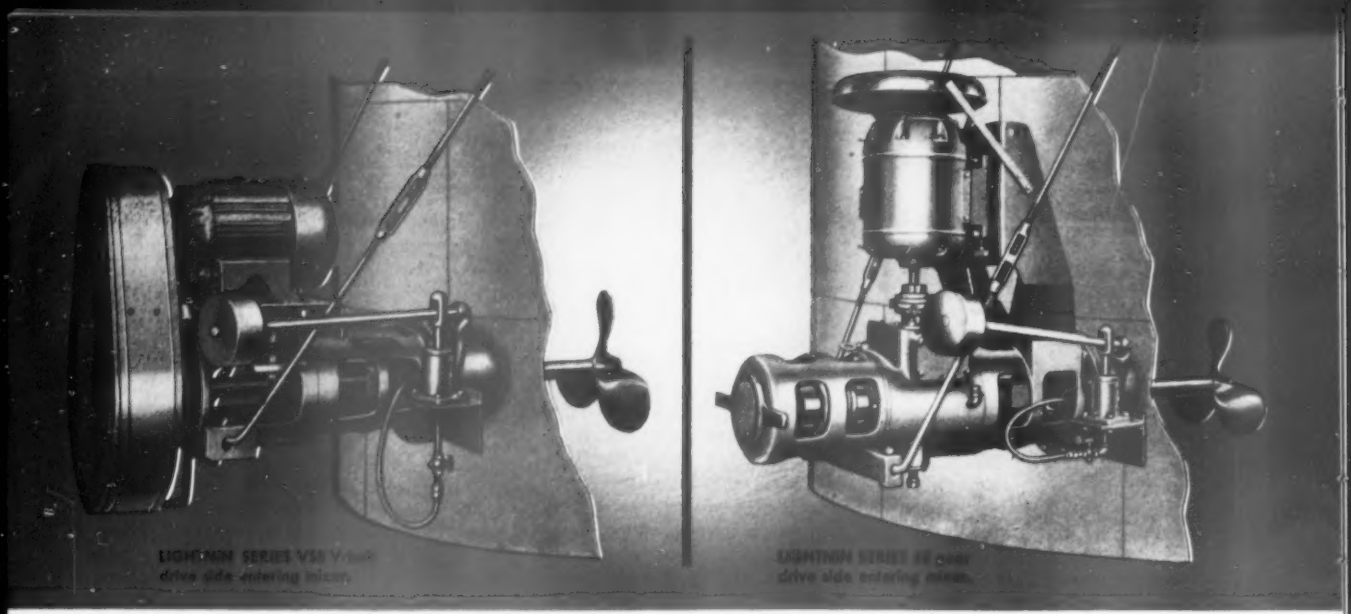


Fig. 4—This curve combines the relevant parts of Figs. 2 and 3 to show variations in apparent resistivity in a qualitative manner (see text).



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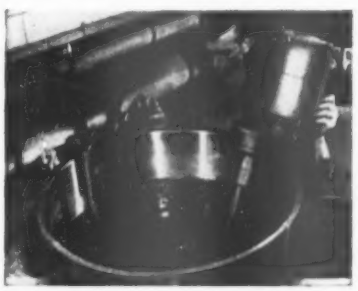

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ASPHALT
ANALYSIS—6

REFINER'S NOTEBOOK

Effect of Processing on Composition

by R. N. Traxler* and H. E. Schweyer†

THE use of component analysis to explain the changes undergone by a residuum when it is processed to asphalt is illustrated in Table 1 and Fig. 1. These data indicate that vacuum reduction produces asphalts through removal by vaporization of the lower molecular weight oils (both paraffinic and cyclic) as shown by a gradual increase in the refractive indices of the paraffinic and cyclic fractions remaining.

In the case of air blowing, the data in Table 2 indicate that the higher molecular weight oils appear to be selectively reacted upon since the refractive indices of the paraffinic and cyclic fractions from an air blown asphalt usually are lower in value than for fractions of the residuum from which it is produced. It should be emphasized that the relative amount of paraffinics and cyclics converted to asphaltics by air blowing varies with different stocks and is also affected by the relative amount of vaporization that occurs during the air blowing process.

*The Texas Co., Port Neches, Tex.
†University of Florida, Gainesville.

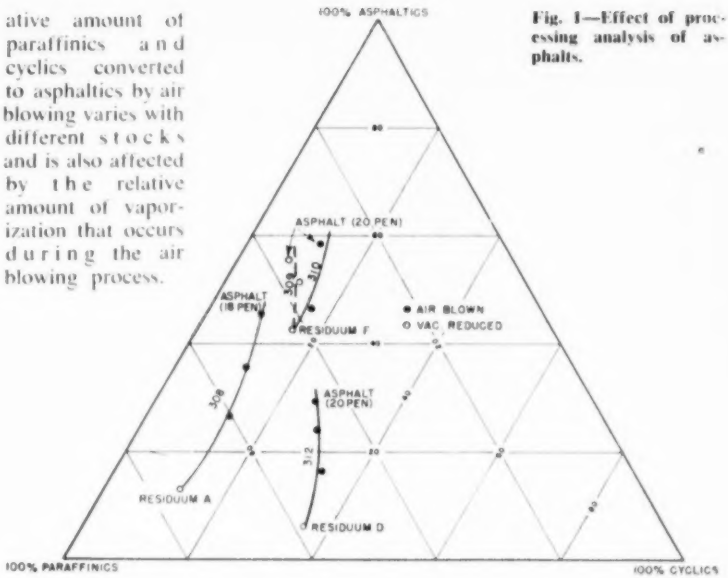

Fig. 1—Effect of processing analysis of asphalts.

TABLE 1—EFFECT OF VACUUM REDUCTION AND AIR BLOWING ON COMPOSITION AND REFRACTIVE INDEX

Source	Number	Process	Softening Point R&B °C.	Softening Point R&B °F.	A.S.T.M. penetration 25° C. (77° F.), 100g, 5 secs.	Asphaltics, %	Paraffinics %	Paraffinics RI*	Cyclics %	Cyclics RI*
A	308-A	Vac. Red.				13.2	74.3	1.5148	12.5	1.5710
A	308-B	Air blown	40.0	104	220	26.7	60.1	1.4998	13.2	1.5594
A	308-D	Air blown	65.6	150	53	35.9	53.8	1.5005	10.4	1.5550
A	308-H	Air blown	138.9	282	18	45.6	45.9	1.5019	8.5	1.5455
D	312-A	Vac. Red.				6.5	58.5	1.5264	35.0	1.5580
D	312-B	Air blown	37.8	100	229	16.4	50.7		33.0	
D	312-D	Air blown	52.8	127	49	24.0	47.7	1.5161	28.3	1.5560
D	312-E	Air blown	73.3	164	21	29.4	45.0	1.5220	25.6	1.5588
F	309-A	Vac. Red.	40.6	105	210	42.6	42.3	1.5172	15.1	1.5659
F	309-C	Vac. Red.	59.4	139	41	51.3	36.8	1.5200	12.0	1.5725
F	309-D	Vac. Red.	75.0	167	17	55.4	36.3	1.5250	8.4	1.5958
F	310-C	Air blown	61.1	142	55	46.0	37.2	1.5417	16.8	1.5649
F	310-D	Air blown	100.0	212	20	58.8	30.0	1.5125	11.2	1.5642

*Determined at 70° C. (158° F.).

TABLE 2—COMPONENT ANALYSIS OF ASPHALTS RECOVERED BY THE ABSON METHOD

Asphalt source—	A		C		A (a)	
Number—	280-A Original	280-B Recovered	281-A Original	281-B Recovered	286-A Base asphalt	287-B Recovered
Soft. point:						
R & B, °C.	65.5	66.7	55.0	55.0	104.4	106.1
R & B, °F.	150	152	131	131	220	223
A.S.T.M. penetration, 25° C. (77° F.) 100 g—5 sec.	53	54	53	49	19	21
Asphaltics—per cent	35.9	32.6	43.8	40.9	41.1	43.1
Paraffinics—per cent	53.8	56.1	35.4	38.2	48.0	46.4
RI/70° C. (158° F.)	1.5005	1.4995	1.5241	1.5200	1.4990	1.4990
Cyclics—per cent	10.4	11.3	20.8	20.8	10.9	10.4
RI/70° C. (158° F.)	1.5550	1.5552	1.5580	1.5652	1.5555	1.5575

(a)—Mineral filler added to base asphalt in an amount to yield a 30 per cent filled asphalt mixture. Base asphalt was recovered from benzene solution using a centrifugal filter (Rotarex) for separating filler. Recovered bitumen contained 5 per cent filler, but component analysis is on filler-free basis.

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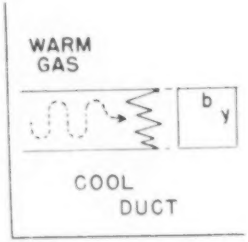
Part 48 of a series

by Dr. B. E. Lauer, Head, Department of Chemical Engineering, University of Colorado

h_f HEAT TRANSFER

COEFFICIENT of HEAT TRANSFER through FILM between INSIDE of COOL DUCT and WARM GAS



Gas Movement: Turbulent

EQUATION:

$$h_f = 0.023 \frac{K}{De}\left[\frac{DeG}{\mu}\right]^{0.8}\left[\frac{C_p\mu}{K}\right]^{0.3}$$

TERMINOLOGY:

h_f - Film coefficient of heat transfer, BTU/hr.sq.ft.°F.

K - Thermal conductivity at average gas temperature, BTU/hr.sq.ft.°F./ft.

De - Equivalent diameter = $4 r_h = 2\ by/(b + y)$, - ft.

b - Width of duct, ft.

y - Depth of duct, ft.

G - Mass velocity, lb./hr. sq. ft.

μ - Viscosity, lb./hr.ft.

C_p - Specific heat of gas at constant pressure, BTU/lb.°F.

LIMITATIONS:

$1 < b/y < 7.0$

$De\,G/\mu > 10{,}000$

Accuracy - $\pm$ 15%

PHYSICAL CONSTANTS:

The values of the physical constants such as density, viscosity, and others are reported in the International Critical Tables, in several handbooks, and in the technical literature.

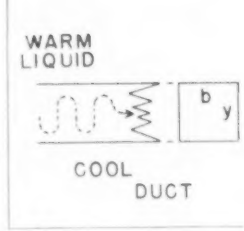
Page references in the Chemical Engineers' Handbook, J. H. Perry (1948) are as follows:

for μ - 370-374, 1198, 1696.
ρ - 130-148, 178-198, 1683.
K - 459-461, 1303, 1697.
C - 998-938, 997, 1688, 1696.

REFERENCES:

1. Heat Transmission, W. H. McAdams, p. 197.

COEFFICIENT of HEAT TRANSFER through FILM between INSIDE of COOL DUCT and WARM LIQUID



Liquid Movement: Turbulent

Special Considerations: Liquids of low viscosity

EQUATION:

$$h_f = 0.023 \frac{K}{De}\left[\frac{DeG}{\mu}\right]^{0.8}\left[\frac{C_p\mu}{K}\right]^{0.3}$$

TERMINOLOGY:

h_f - Film coefficient of heat transfer, BTU/hr. sq. ft. °F.

K - Thermal conductivity at average water temperature, BTU/hr. sq. ft. °F./ft.

De - Equivalent diameter = $4 r_h = 2\ by/(b + y)$, - ft.

b - Width of duct, ft.

y - Depth of duct, ft.

G - Mass velocity, lb./hr. sq. ft.

μ - Viscosity, lb./hr. ft.

C - Specific heat, BTU/lb. °F.

LIMITATIONS:

$1 < b/y < 7.0$

$De\,G/\mu > 10{,}000$

Accuracy - $\pm$ 15%

PHYSICAL CONSTANTS: The values of the physical constants such as density, viscosity and others are reported in the International Critical Tables, in several handbooks, and in the technical literature.

Page references in the Chemical Engineers' Handbook, J. H. Perry (1948) are as follows:

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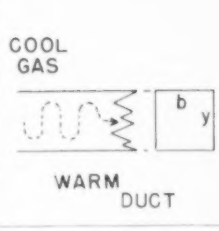
REFERENCES:

1. Heat Transmission, W. H. McAdams, p. 197.

COEFFICIENT of HEAT TRANSFER through FILM between INSIDE of WARM DUCT and COOL GAS



Duct Position: Horizontal

Gas Movement: Turbulent

EQUATION:

$$h_f = 0.0203 \frac{K}{De}\left[\frac{DeG}{\mu}\right]^{0.8}$$

TERMINOLOGY:

h_f - Film coefficient of heat transfer, BTU/hr. sq. ft. °F.

K - Thermal conductivity at average air temperature, BTU/hr. sq. ft. °F./ft.

De - Equivalent diameter of duct = $4 r_h = 2\ by/(b + y)$, ft.

b - Width of duct, ft.

y - Depth of duct, ft.

G - Mass velocity, lb./hr. sq. ft.

μ - Viscosity, lb./hr. ft.

LIMITATIONS:

$8.9 < b/y < 40.0$
$De\,G/\mu > 15{,}000$
Accuracy - $\pm$ 8%

Equation above for air. Probably applicable to diatomic gases and other gases which obey laws as perfect gases.

PHYSICAL CONSTANTS: The values of the physical constants such as density, viscosity and others are reported in the International Critical Tables, in several handbooks, and in the technical literature.

Page references in the Chemical Engineers' Handbook, J. H. Perry (1948) are as follows:

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ρ -- 130-148, 178-198, 1683.

REFERENCES:

1. L. Washington and W. T. Berks, Ind. & Eng. Chem., 29, 327 (1937)

EQUIPMENT MEN . . . in the News

Foster Cathead Acquired By Three Firm Members

W. W. FOSTER

The entire ownership of Foster Cathead Co., Wichita Falls, Tex., was acquired September 1 by three active members of the firm—W. W. Foster, general manager; J. Lewis Foster, engineer; and Glenn Tedford, sales and service manager.

Foster established the company in 1927. His oil-field experience began in 1901 at Spindletop, where he was a drilling contractor.

J. L. FOSTER

G. TEDFORD

According to Foster, the recent change in ownership does not alter the company's management or facilities. The engineering end of the firm has been directed since its early days by Lewis Foster, and Tedford has served as field service expert since 1946.

Foster Cathead engages exclusively in the manufacture of catheads and closely related products. Foster Catheads have been used in drilling three of the last four holes to set world depth records, including the new record set recently by Ohio Oil Co. at Bakersfield, Calif.

Allis-Chalmers to Acquire Buda Engine Assets

Transfer of the assets of Buda Co., Harvey, Ill., to Allis-Chalmers Manufacturing Co., West Allis, Wis., is expected to be completed around the end of October, it was announced recently by W. A. Roberts, Allis-Chalmers president.

The time for dissenting shareholders of Buda Co. to demand payment for its shares expired September 30. The number of shares dissenting was so small that completion of the transaction pursuant to the plan of reorganization between the two companies is now assured, subject to various closing requirements of the plan.

Oilwell Appoints Shepherd Manager of Tubular Sales

P. H. SHEPHERD

The appointment of Paul H. Shepherd as manager of tubular sales for U. S. Steel's Oil Well Supply Division has been announced by Fred F. Murray, president of Oilwell. Shepherd replaces John M. Post, retired, and will continue to headquarter at Dallas.

Shepherd entered the employ of Oilwell in 1916 as storeman at Winchester, Ky. In 1926 he was appointed manager of the Pampa, Tex., store, and in 1929 was named manager of the Pampa district. In 1946 he was made division manager of the Oilwell Gulf Coast area, and in June 1950 was appointed assistant manager, tubular sales.

Memorial Plaque Presented To Fort Worth National Bank

A bronze bas-relief plaque of the late Robert Ellison Harding, chairman of the board of The Fort Worth National Bank, was presented to the bank by the 454 members of the bank staff at a ceremony held October 5. The 32 x 34-in. bas-relief of Harding is the work of Charles Umlauf, Texas sculptor, who was commissioned by the members of The Fort Worth National Employe Family in the spring of 1952. The plaque is located inside the main banking room at the West Seventh Street entrance.

Buckeye to Distribute Carter Units in Kansas

S. C. Carter Co., Inc., Los Angeles manufacturers of the Carter long-stroke hydraulic pumping unit, has announced the appointment of The Buckeye Supply Co. as distributors for the State of Kansas.

Buckeye Supply, which already distributes Carter units in Ohio and West Virginia, will handle sales and service in Kansas from its offices at Chase, El Dorado, and Great Bend.

American Pipe & Steel Adds Vaughan to Oil-Field Division

H. K. VAUGHAN

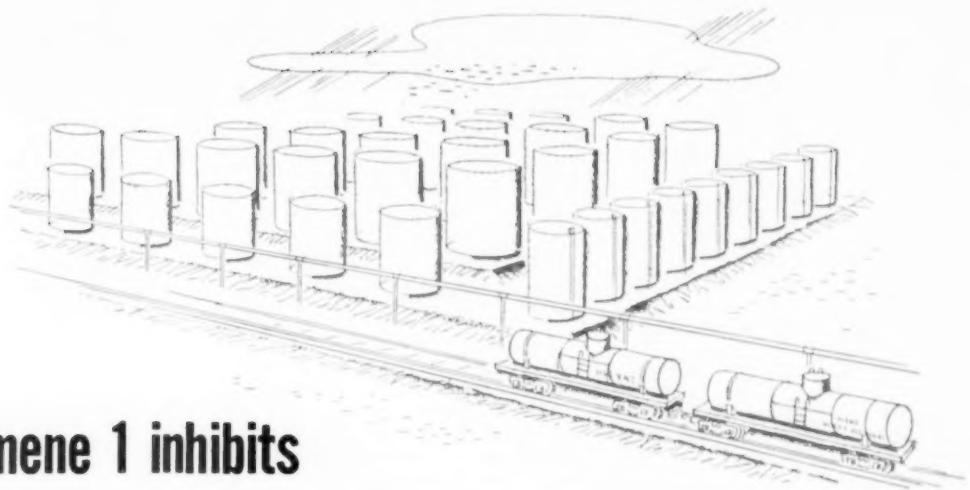
H. K. (Brick) Vaughan, well known in the California oil industry for over 25 years, has been appointed to the oil-field division of American Pipe & Steel Corp., Alhambra, Calif., according to an announcement made by Carl B. Dahlberg, vice president in charge of sales for this 50-year-old steel fabricating company.

Vaughan, a mechanical engineer, will specialize in the products and services of the company as applied to the oil fields of the State of California. His appointment represents a further strengthening of the engineering, sales, and service staff of the oil-field division of American Pipe & Steel, a West Coast manufacturer offering a complete line of production equipment to California oil producers and refiners.

West Made General Sales Manager of Climax Engine

Carl G. Preis, president of Eversharp, Inc., has announced the appointment of E. D. West as general sales manager of its Climax Engine and Pump Manufacturing Division, with headquarters in Chicago. West has been associated with Climax for 19 years as a sales executive.

Two additional appointments were also announced by Preis. Fred W. Neubauer, who has been with Climax for 35 years, has been appointed plant manager of its Climax Manufacturing Division located at Clinton, Iowa. Ted



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Tulsa Chapter of Nomads Holds First 1953-54 Meeting

The Tulsa Chapter of Nomads held its first meeting of the 1953-54 season on September 18 at Southern Hills Country Club. It was held at Snug Harbor, and, as had been decided earlier in the year, the theme of the gathering was to honor the past presidents of the Tulsa chapter. The program and entertainment was handled by Robert C. Glover, Baker Oil Tools, Inc.; Stanley W. Wilcox, Seismograph Service Co.; Jack Beesley, Baroid Sales Co., and Don Collins, Republic Supply Co. Past presidents who were able to attend this meeting are pictured, front row, left to right: C. O. Willson, The Oil and Gas Journal; P. E. Fitzgerald, Dowell Incorporated; H. A. Bourne, Republic Steel Corp.; Stanley W. Wilcox, Seismograph Service Co., and M. D. Gilbert, Rockwell Manufacturing Co. Back row: K. O. Hoevel, National Supply Co.; Shep Miers, Southwest Supply Co.; G. W. Davidson, W. C. Norris Manufacturing Co.; H. M. Cooley, Bethlehem Steel Corp.; Opie Dimmick, Century Geophysical Co.; C. F. Coons, National Tube Division, U. S. Steel Corp.

Skeen, district manager with headquarters in Dallas, will be in charge of sales and service throughout the Mid-Continent area. E. J. Anselman, former general manager, has resigned.

Two Sales Promotions Announced by Blaw-Knox

RODGERS

William Rodgers has been elected vice president and general sales manager of Blaw-Knox Co., according to an announcement by W. Cordes Snyder, Jr., president. The company also announced the appointment of E. P. Addition as sales engineer for the chemical-plants division.

Rodgers joined the company in April 1953 in the new staff post of general sales manager. For many years he was in the construction-materials business and in recent years, prior to joining Blaw-Knox, was in the motor-transport field.

Addition will be located at the Pittsburgh office, and will offer the processes and engineering-construction services of the company to chemical and industrial clients in a five-state area. Prior to his present assignment, Addition held engineering positions in chemical-plans division over a 10-year period, and had earlier employment with Barrett Division of Allied Chemical & Dye Corp., and Calco Division of American Cyanamid Co.

Acme Oil Tool Names Seachris Sales Manager

O. L. SEACHRIS

O. L. (Tony) Seachris was recently named sales manager of Acme Oil Tool Co., according to the company's president, Bill Warner.

Seachris' oilfield experience includes 15 years as a driller and tool pusher, and 6 years as a fishing-tool operator in Oklahoma, Kansas, and North Texas.

Acme Oil Tool Co. is located in Oklahoma City and Wichita Falls and is also affiliated with Great Bend Fishing Tool Co. in Great Bend, Kans.

Baash-Ross Opens New Office in Fort Worth

LAUDERMILK

H. (Ink) Wotkyns, vice president in charge of Mid-Continent operations for Baash-Ross Tool Co., has announced the opening of a new sales office in Fort Worth, to handle the steadily increasing activities of the company in the Fort Worth-Dallas area, heretofore handled out of the Oklahoma City plant.

C. M. Laudermilk, formerly repre-

senting Baash-Ross in the Shreveport area, has been transferred to Fort Worth to take charge of the new sales office.

Laudermilk brings to his new location an extensive background of experience in Mid-Continent and Gulf Coast operations, both in shop and field service as well as in oil-field sales. He will make his headquarters in Fort Worth, from which point he will cover the oil activities of the mid-Texas region.

Laird Joins Cardwell As California Representative

L. J. LAIRD

Lee J. Laird has recently joined Cardwell Manufacturing Co., Inc., Wichita, as its California representative, according to Robert M. Smith, Cardwell sales manager.

Laird was formerly assistant general sales manager of Baash-Ross Tool Co. He has been associated with the petroleum industry since 1928, working first with Republic Supply Co. of California. Laird also served for several years with Chiksan Co.

Dowell Advances Three in Sales Management

R. H. SMITH

R. D. SHAW

Announcement was made recently of the advancement of three men in the sales-management department of Dowell Incorporated by A. C. Polk, vice president and general manager, in Tulsa.

Ralph H. Smith was named director of sales, which position has been held for the past 21 years by Robert D. Shaw, who joined The Dow Chemical Co., just prior to the organization of Dowell in 1932. Shaw, who will retire in less than 2 years, will be senior sales consultant. He will be chief adviser to Smith at the Dowell general offices in Tulsa.

B. E. (Ted) McCann, formerly assistant sales manager, becomes general sales manager. Ray S. Ousterhout, former district sales manager in Dowell's Midland, Tex., district, will fill the position vacated by McCann.

Smith is the former district manager of Dowell's West Texas district at Midland. He joined Dowell in 1944 as district engineer of the company's Houston, Tex., district. In 1948 he became Houston district manager, and was named to the Midland post in 1950.

McCann joined Dowell in 1946. He has been in the Dowell sales department for the past 3 years, after 4 years

B. E. McCANN

R. OUSTERHOUT

of field experience as a service engineer and sales engineer.

Ousterhout began with the company in 1943 as an analytical chemist and returned to the company in 1946 after 2 years of military service. In West Texas he advanced from service engineer to the district sales post.

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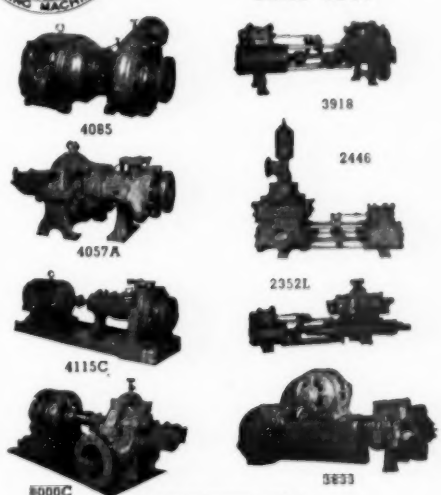

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DIGEST OF NEW EQUIPMENT

IT'S NEW — CHECK IT

TRADE LITERATURE

1 J-M PRODUCTS FOR THE PROCESS INDUSTRIES, a new eight-page catalog, gives concise data on the properties of the various products and includes photographs which show typical installations. It is arranged as a ready reference for men who design, install, and operate process equipment. The products covered are: industrial insulations for temperatures from minus 400° to plus 3,000° F., refractories and insulating brick for furnaces, ovens, and kilns operating to 3,000° F., Transite pipe for overhead and underground water lines and for process lines handling corrosive liquids and gases, transite industrial vent pipe for venting gases, fumes and vapors, packings and gaskets including acid and caustic-resisting types, raschig rings for tower packings, and J-M Chemstone and Transite sheets for various types of fabricated equipment. *Johns-Manville.*

2 POWER AND FLUIDS. This new magazine will present articles and other editorial material of such caliber as to establish it as a reference for its field. Power and fluids will be presented quarterly, and the editorial content will consist of information in the power and fluid-handling fields. It will describe new product applications, processes, and methods. Subjects covered will include installations, operation, and maintenance of industrial apparatus and applications of particular interest because of specific problems involved. *Worthington Corp.*

3 SPEED REDUCER BOOKLET. A new 15-page booklet, describing the complete line of Westinghouse speed reducers. Features the equipment, manufacturing techniques, and applications. Standard ratios available for all types of speed reducers are given. Special units developed for right-angle drives, and in-line drives are discussed. *Westinghouse Electric Corp.*

4 BULLETIN NO. 393 presents the Ideal Consolidated Type T-20 rig rated at 200 hp. Service capacity, construction features, and controls are described and illustrated in color. Also included in the 20-page booklet are specifications, performance chart, mobile mountings, and dimensional diagrams for four arrangements. *The National Supply Co.*

5 WELD STRENGTH CALCULATOR has been made for the convenience of designers, engineers, and others interested in steel-plate fabrication. The weld-strength calculator is a durable plastic slide rule that indicates both the size of weld required for a given applied load and the weight of a given length of weld in pounds. The calculator gives values for stresses ranging from 2,000 to 20,000 psi. and applied loads of from 9,000 to 450,000 lb. *Lukens Steel Co.*

6 WHITLOCK PROCESS EQUIPMENT. Data tables, engineers' drawings, and descriptions of U-tube, straight tube-floating head, straight tube-fixed tube sheet, coil type, and double-pipe heat exchangers are included in an eight-page, two-color bulletin. One page shows details of design and construction on front closures, tube-tube sheet seals, tube and shell passes, and rear closures. *The Whitlock Manufacturing Co.*

7 McEVOY SELF SEALING GATE VALVES. This new bulletin No. 101 gives complete information on the A.P.I. and A.S.A. round port-through conduit, two-way full, and regular port valves. It also contains A.P.I. oil-field

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Corresponding to new equipment items or trade literature abstracts in the Oil and Gas Equipment Digest of The Oil and Gas Journal, Oct. 26, 1953

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ratings, A.S.A. table of maximum service pressure ratings on all valves with temperature ranges and prices. *McEvoy Co.*

8 NEW LOW DIFFERENTIAL FLOW METER CATALOG. An eight-page booklet on the new Diaflow meter gives important data on this meter for measuring air flow, gas flow, and the ratio of air flow to gas flow. Employs pilot method of operation, dry diaphragm-type measuring element, package unit construction. *The Hays Corp.*

9 EXHAUST PURIFIER FOR GASOLINE ENGINES OCM catalytic exhaust, a device for removing carbon monoxide, fumes and odors from all types of gasoline-powered equipment, is illustrated and described in a four-page folder. As pointed out in the folder, the OCM catalytic exhaust permits safe indoor operation of gasoline engines. *Oxy-Catalyst, Inc.*

10 MUNICIPAL AND INDUSTRIAL WASTE PUMPS. The new 12-page booklet covers features, performance information, specifications and selection data for plunger sludge pumps, mud-hog diaphragm pumps, and self-priming centrifugal pumps used on sludges and slurries. *Marlow Pumps.*

11 WHEELCO DATA BOOK AND CATALOG. A complete line of thermocouples, radiation, detectors, and resistance bulbs is shown in Bulletin TC10. It has a great deal of valuable information concerning various sensing units as well as tips on instrument servicing. This new 42-page catalog also includes information on protection tubes, lead wire, and other accessories for use with indicating, controlling, and recording instruments. *Wheelco Instruments Division, Barber-Colman Co.*

12 OXYGEN - INDEX OF COMBUSTION PROCESSES is a new bulletin which graphically illustrates and explains how too much or too little air can have costly effects in combustion processes. It points out that by using oxygen as the criterion to proper combustion, greater over-all process efficiency and more profits can be realized. Bulletin shows how oxygen in flue gases will indicate almost exactly the same excess air factor for any fuel from coke to natural gas. *Arnold O. Beckman.*

13 SMALL CAPACITY CONTROLLED VOLUME PUMPS. The new bulletin gives complete data on capacities, pressures, materials of construction, as well as operating details. Some of the many variations of this line are illustrated to show typical speed and stroke length control of capacity; constant flow; air operated; and multiplex units. Cutaway views illustrate the step valve and the new double-ball check column valve liquid ends. *Milton Roy Co.*

14 MIEHLE-DEXTER SUPERCHARGERS. How this unit boosts the power of diesel and gasoline engines is the subject of a new descriptive bulletin. This four-page folder illustrates and describes the supercharger and points out that the addition of this equipment to current or projected designs is said to be easy and is often a less costly way to obtain additional power without increasing space requirements or engine weight. *Dexter Folder Co.*

15 A NEW DATA CARD, designed to help individuals involved in design and operation of tubular equipment at elevated temperatures and pressures, tabulates the maximum allowable stress values of a complete range of seamless and welded carbon, alloy, and stainless-steel tubing and pipe. An adaptation of Table P-7 of the new A.S.M.E. boiler code, the data card is complete with notes and formulas for calculation of maximum allowable working pressures of tubing and pipe. *The Babcock & Wilcox Co.*

16 GAS ANALYSIS APPARATUS. A newly published 48-page catalog 81 lists and describes equipment and accessories for gas analysts. The new book outlines methods in brief, lists many different models and types of apparatus, and offers aid for proper selection. All major items are described in detail and are clearly priced. A complete subject index is keyed to page numbers. Each page is identified by subject. *Burrell Corp.*

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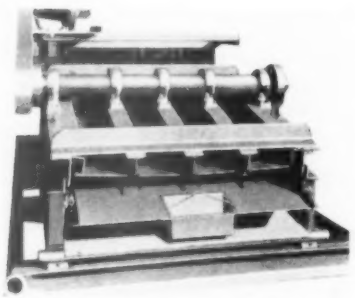
DIGEST OF NEW EQUIPMENT

IT'S NEW ✓ CHECK IT

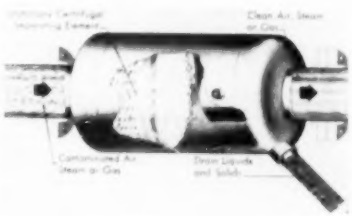
by Dan B. Miller

17 NEW MODEL "RUMBA" SHALE SHAKER has a desander pan and removable sample catcher. With this completely new desander pan, even flour sand particles can be removed from the drilling mud, thereby restoring the desirable, clean, nonabrasive properties to the drilling mud. Sand is removed through the shaker's flotation process. With this process, adhesion holds droplets to the bottom of the screen cloth. As the fine sand sifts through the cloth it is caught in the droplet and held until the weight causes it to drop off into the desander pan. Water jets keep the sand moving in the desander pan. A removable sample catcher is built into the shaker enabling the geologist to obtain samples for analysis at intervals as desired. *Hutchison Manufacturing Co.*



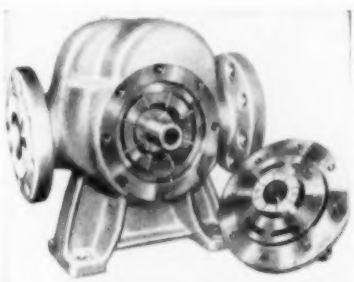
IT'S NEW ✓ CHECK IT

18 Hi-eF PURIFIER FOR NATURAL-GAS LINES. This purifier designed to remove wet and dry particles in natural-gas lines at compressor stations, is said to remove 99 per cent of all entrainment in natural gas without the use of any moving parts. This unit has an exclusively designed stationary centrifugal element which imparts a carefully controlled but extremely rapid rotational motion to the vapor. This action draws all solids and liquids out to the walls of the purifier where they are carefully collected and ejected out the drain. The clean, dry gas continues through the purifier outlet. The unit actually increases in efficiency as velocity of the gas increases, resulting in virtually 100 per cent removal of entrainment. These units need no attention whatsoever, are self-cleaning, self-draining, and have no moving Parts. Pressure drop through the units is surprisingly low. *The V. D. Anderson Co.*



IT'S NEW ✓ CHECK IT

19 A NEW HEAVY-DUTY PRECISION-BUILT PUMP for handling crude oil, refined oil, and distillates is especially suited to oil-field gathering systems and product pipe lines. This is a vane-type pump, with a balanced rotor, and is available in 2, 3, and 6-in. pipe sizes. It operates at speeds of 600 to 1,200 r.p.m. Capacities range up to 850 g.p.m. (1,214 bbl. per hour) and discharge pressures up to 600 psi. It is rugged and compact. It provides positive displacement and positive suction, and gives a nonpulsating discharge. Rotation and flow are readily reversible. The pump is easily serviced without breaking the line, and all parts are standard for quick replacement. Other features of this pump, which has been thoroughly proven in actual field service, include high efficiencies over a wide range of speeds and pressures, inboard ball bearing to absorb drive-shaft loads, and hydraulic balancing to reduce the load on the main bearing. It is built for outdoor all-weather service. *The Marquette Metal Products Co.*



IT'S NEW ✓ CHECK IT

20 A NEW AND IMPROVED GAS CHECK VALVE has been incorporated in the McEvoy gas lift. The principle upon which this gas tube check valve works is as follows: As soon as gas flow begins, the ball is lifted against the rubber pad by the pressure drop through the valve. It remains fixed in this position as long as any appreciable amount of gas is flowing through the valve. The instant

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that the valve closes, and pressure reverses, the ball drops onto its seat sealing tightly against backflow of the gas or well fluid. The advantages of this improved check valve are: the entire check valve assembly is readily removable through the opening under the ¾-in. pipe plug; the ball and seat are replaceable and the threaded connection can be broken for inspection when the valve is being repaired; with the pipe plug and check-valve assembly removed, an access opening is available for cleaning the gas tube with a rod or wire. *McEvoy Co.*

IT'S NEW CHECK IT

21 NEW INTEGRATOR - INDICATOR. A miniature integrater-indicator incorporates a full-size integrating mechanism and standard five-digit counter. It is one of the company's series of Ratographic miniature instruments designed primarily for mounting in graphic panels. The unit, measuring 6 by 6 by 14⅝ in., indicates instantaneous rate and continuously integrates the measured variable.

The high-speed integrating unit senses and totals flow rate of the measured liquid or gas every 2.5 seconds. This rapid counting rate allows varying flows to be totalized to accuracies within 1 per cent of full scale. Instantaneous flow rate is indicated on a vertical strip by a pointer attached to the integrator calibration cam. The pointer is positioned along with the cam by a pneumatic receiver which operates at signal pressures of from 3 to 15 psig. *Fischer & Porter Co.*

IT'S NEW CHECK IT

22 POCKETAIRE is a new type of 30-minute self-contained breathing apparatus. Weighing 8½ lb. complete, it features a 5-minute escape cylinder which may be opened when the large cylinder is exhausted, thus making it unnecessary for the user to keep track of the supply available by watching the pressure gage. Designed for use with oxygen, it may be recharged from any standard oxygen cylinder, and delivers sufficient volume so that it may be used as an emergency inhalator. The same model, with two 5-minute cylinders, weighs only 4 lb. complete with mask and shoulder holster. *Cycle-Flo Co.*

IT'S NEW CHECK IT

23 PRODUCTION PACKER TYPE J was designed to perform properly under severe well conditions, and to meet demands for a packer that would run, set, pack off indefinitely, release, and pull easily. The packer has a special latch mechanism that makes setting and relatching easy. The enormous slip area is built to take any loads placed on the slips and head without damage to the tool or casing. This large area makes the slips release with minimum pull. The spring-loaded friction shoes will permit miles of travel without appreciable wear. The oil and heat-resisting element will not bond to the casing and has, molded as a part of the element, flexible metal baskets which form a metallic block to prevent cold or hot flow under high pressures. Unusually large circulation areas and full opening through the tube of the packer are important advantages. With a holddown installed above the packer, the packer is perfectly adapted for high-pressure uses such as acidizing, sand fracturing, and such similar applications. Crossovers installed above the packer provide excellent installations in dually completed wells. *Equipment Engineers, Inc.*

IT'S NEW CHECK IT

24 BARREL BEARING. Accurately ground barrel-shaped rollers, combined with precise race contours, provide maximum load-carrying capacity throughout a wide range of operating conditions. These angular contact bearings are designed to sustain radial, thrust, or combination loads and are freely self-aligning. Conditions of shaft misalignment do not interfere with their operation. The new bearing has been thoroughly proved in a variety of industrial applications, such as tractors, textile, machinery, and oil-field equipment. *Hyatt Bearings Division, General Motors Corp.*

IT'S NEW CHECK IT

25 NEW TYPE GAS-SAMPLING PUMP is for use in conjunction with gas-analyzing equipment. Since the gas is never in contact with metal and since the design of the pump eliminates stuffing boxes and shaft seals, there is no possibility of either contaminating the gas or leakage of the gas from the pump. The pump utilizes an eccentric shaft and rotor assembly which rotates inside and actuates a durable precision molded flexible liner. The gas which is trapped on the outer surface of the Flex-i-liner and the inner surface of the body block is progressively squeezed through the pump. Molded flanges on the Flex-i-liner are pressed to both sides of the body block by end plates, sealing off the fluid passage from contact with moving parts. Since the only two parts in contact with the fluid are the

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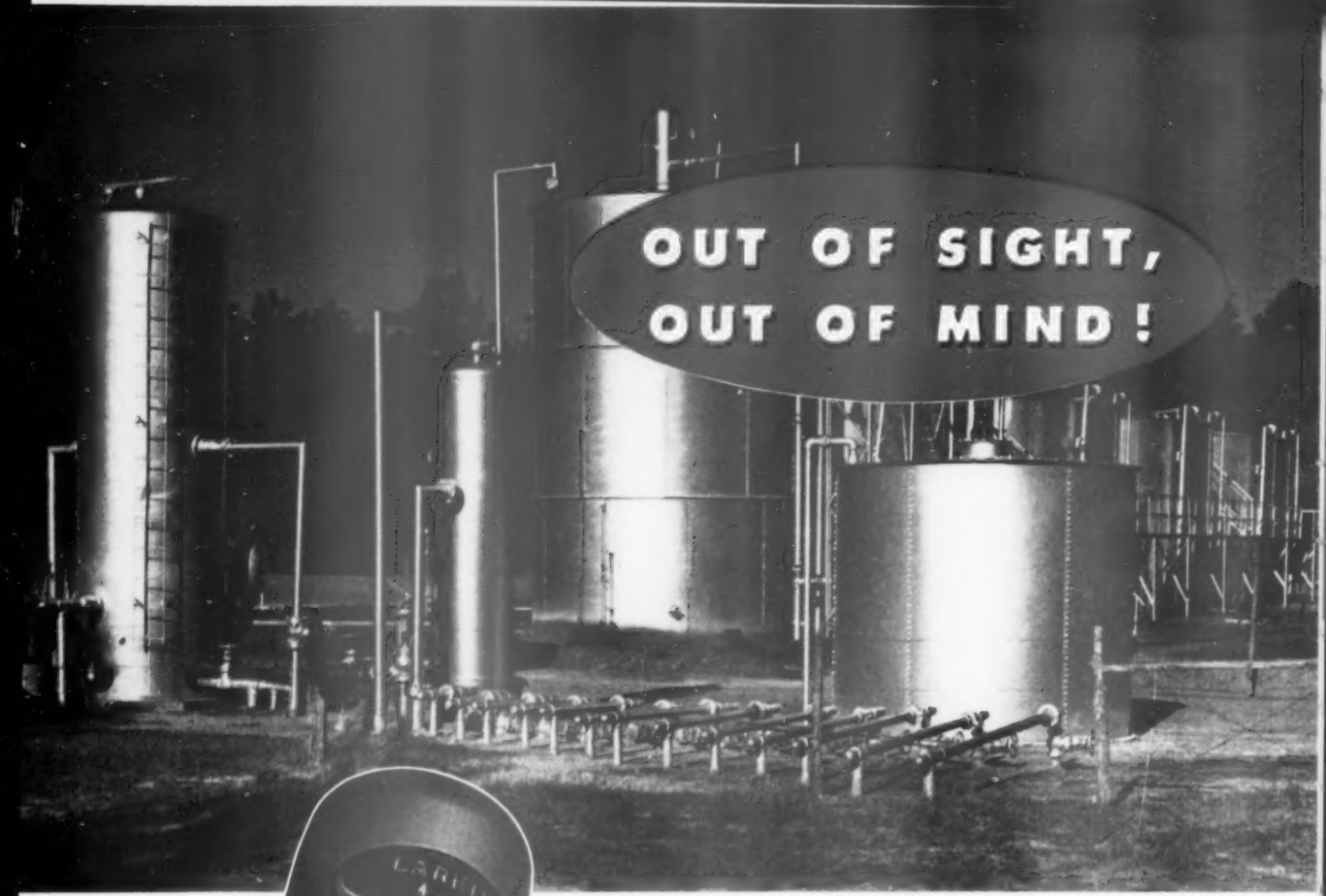

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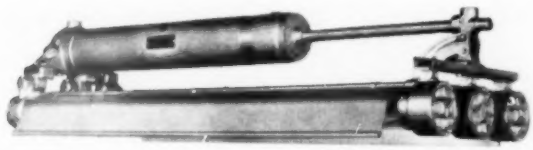
pump body block and Flex-i-liner, these two parts are supplied in a wide variety of corrosion-resistant materials. Where continuous operation is required and where relatively high vacuums and discharge pressures are specified, the firm offers a reservoir which is placed directly above the discharge in the discharge line. This reservoir can be filled with either water or silicone oil or any other fluid which will not affect the gas sample or dissolve the gas thereby making a positive seal between the outer surface of the Flex-i-liner and the inner surface of the body block. The use of this oil reservoir enables capacities from 0-35,000 cc. per minute with discharge pressures from 0-35 psi. and suction lifts up to 22-in. Hg. *Vanton Pump Corp.*

IT'S NEW CHECK IT

26 NEW UNIT 1520 UNDERCARRIAGE. A new heavy-duty undercarriage specifically designed for the purpose of providing a solid foundation to withstand the stresses of crane operation is now being built for Model 1520 self-propelled mobile crane which is rated ¾ yard with a lifting capacity up to 20 tons. The new all-welded undercarriage provides stability in the handling of extremely heavy loads. Alumetallic clutch parts are constructed of high-tensile aluminum which dissipates heat rapidly. The front, center, back, and lining plates are all aluminum alloy and are faced with bimetallic linings which are matched making a lining-to-lining frictional contact. *Unit Crane & Shovel Corp.*

IT'S NEW CHECK IT

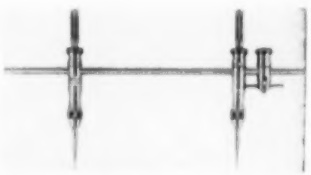
27 EXPLOSIONPROOF, DUST-TIGHT FLUORESCENT LIGHTING FIXTURE is for use wherever the presence of explosive gases, or vapors, or combustible dusts requires safe, practical, lighting. The fixture may be



spaced end to end with other fixtures of its same type, making possible continuous and uniform illumination along work areas. Each fluorescent tube is housed in an individual tube of heat-resisting glass. The tube ends are reversed tapered and sealed into cast aluminum housings which also contain the lamp receptacles. The receptacle housings at the ballast ends are pivotally connected to the ballast housing. At the relamping ends, the receptacle housings are fastened to a supporting stem assembly which is attached to the ceiling or a structural building member. Fixture's reflectors are accurately formed sheet metal of interior white enamel and exterior aluminum finishes. Securely attached by spring clips, they easily may be inserted or removed after the fixture has been hung. A link member that is part of the supporting stem assembly allows the relamping end of the fixture to be lowered several inches for easy access without interference by adjacent fixture. *Crouse-Hinds Co.*

IT'S NEW CHECK IT

28 STEEL BEAM TRAMMELS NO. 180 series are designed and manufactured in every way to produce an accurate and easy-to-use tool for layout work, scribing, and measuring. Free-turning knurled grips on top of each tram make the tool more convenient to use. Trams will not turn once set, as the top of the rigid beam is flattened. Spring friction prevents the trams from sliding off the beam when the clamping nuts are loosened. Scriber points are hardened for longer wear. Fine-thread adjusting screw gives accurate and fine adjustment of the points. Trammel beams are 10½, 14½, and 20 in. long. With 20-in. extension beam, circles up to 72 in. in diameter can be scribed with the 20-in. trammel. *The Lufkin Rule Co.*



IT'S NEW CHECK IT

29 MASS SPECTROMETER ANALYTICAL SERVICE. Available on a per analysis basis is a permanently staffed laboratory equipped with the latest C.E.S. instruments, including the 21-103B and 21-401 mass spectrometers, the 24-101A leak detector, the Spectro-Sadic, and the 30-103 electrical computer. All sample runs, analyses, tests, and computations are made by personnel having broad knowledge of both chemical and specialized analytical fields, thus insuring accuracy and prompt service. Both Western Union and TWX installations speed reports of urgently needed analyses. Pure samples submitted for isotope assay (e.g. N^{15} N^{14}) are measured on the 21-401 mass spectrometer, while the 21-103B model is used for chemical analyses of gaseous and light-liquid mixtures. Precise analyses can be made on virtually any organic or inorganic gas or liquid mixture for as many as 20 unknown substances with molecular weights up to 300. Trace and purity determinations for 0.001 mole per cent can also be made. Sample requirements for both the analytical and isotope ratio mass spectrometers are unusually small, recommended quantities being 100 cc. for gas and 5 cc. for liquid, although much smaller quantities are regularly analyzed. A Model 30-103 electrical computer is available for rapid solution of simultaneous linear equations such as those resulting from mass spectrometer or infrared applications. *Consolidated Engineering Corp.*

IT'S NEW CHECK IT

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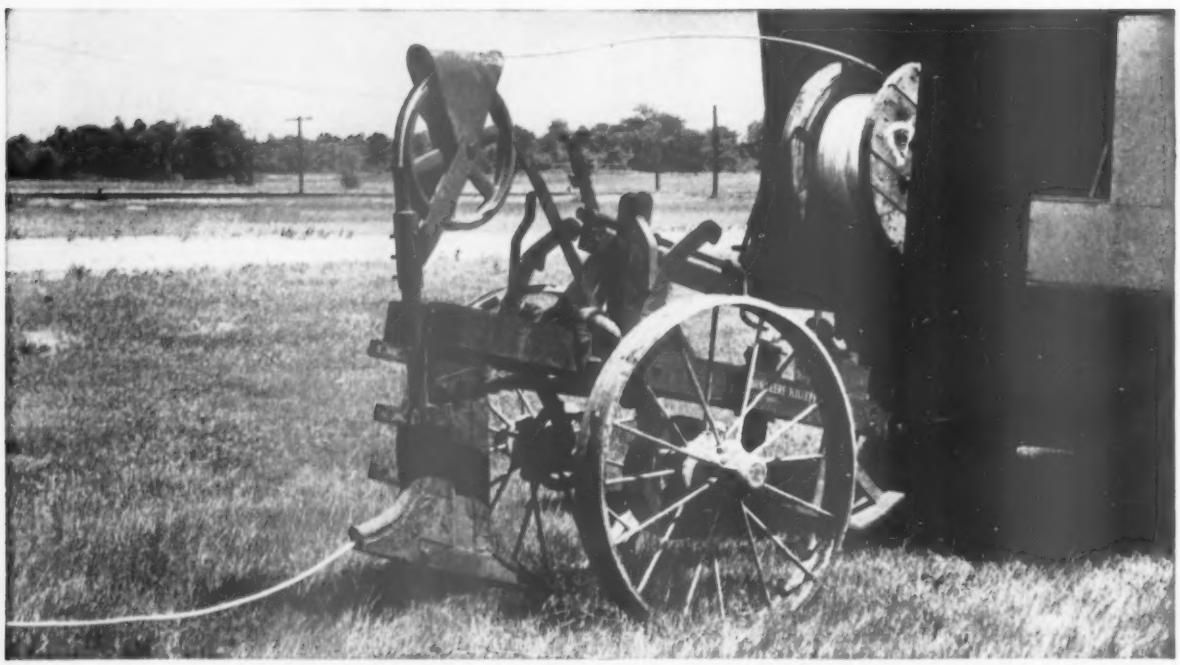
Dow's Magnesium ribbon anode saves time and labor in installation



Galvo-Line is installed by wire-laying plow drawn by truck or tractor.

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Up to *five miles of pipeline per day* can be protected by plowing in Galvo-Line. The installation is also simplified by the fact that the number of connections to the pipeline can be considerably reduced. Intervals of 500 to 1000 feet are generally adequate.

Galvo-Line cuts costs another way, too. It provides from three to seven times as much current per pound of magnesium installed as conventional magnesium anodes. More uniform distribution and efficient utilization of current make Galvo-Line both economical and dependable for pipeline protection.

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DOW

PIPE LINE

Gas Lines Pushed

P.G.&E. welding 34-in. loops along "Super Inch"

SAN FRANCISCO.—Crews are welding about 4,000 ft. per day of 34-in. loop lines along Pacific Gas & Electric Co.'s 502-mile Super Inch, which is undergoing its second major expansion.

An 88-mile section, which is being handled by Engineers Limited Pipe Line Co., extends from Kettleman Hills in Fresno County to a point near Arvin in Kern County, California. It is expected to be completed by April.

All told, about 220 miles of loops will be laid as part of the expansion program. The other sections will consist of 87.8 miles of loops between Newberry and Danby, Calif., in San Bernardino County, an 8-mile segment near Mojave, Calif., and a 32-mile section starting north of Hollister, Calif., and terminating south of the city.

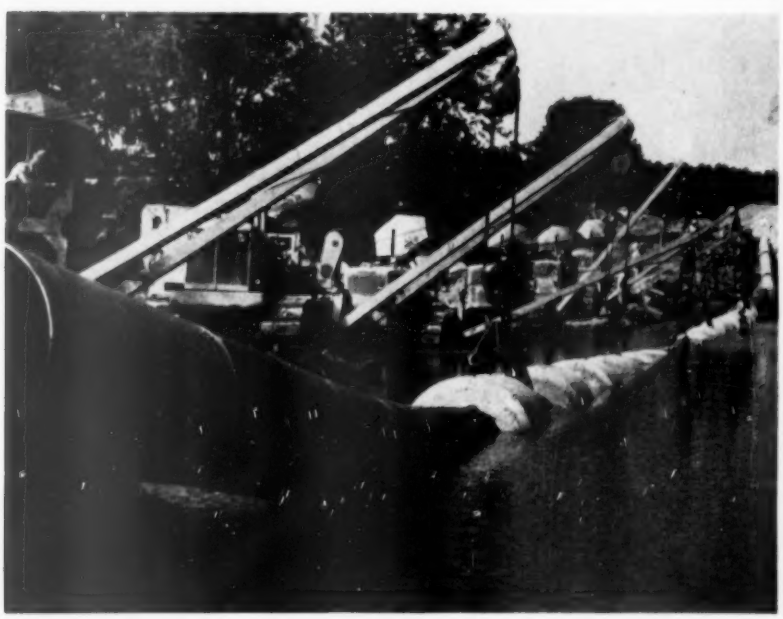
Capacity hiked steadily . . . The 34-in. system, which opened in 1950, extends from a point west of the Colorado River near Topock, Ariz., through San Bernardino and Kern counties, up the west side of the San Joaquin Valley to Milpitas, Calif., near here. Initially, its capacity was 400,000,000 cu. ft. of gas daily, but 2 years ago the line was expanded to 550,000,000 cu. ft. per day. The present expansion will add another 150,000,000 cu. ft. to the line's daily capacity.

To meet this new demand, El Paso Natural Gas Co. is building a 771-mile, 30-in. transmission system from West Texas and New Mexico producing areas to Topock. The new system will transport 300,000,000 cu. ft. of gas daily, of which P.G.&E. will get half and Southern California Gas Co. and Southern Counties Gas Co. will get the remaining 150,000,000 cu. ft.

In addition to the new loop lines, P.G.&E. plans to lay an 8-mile, 30-in. line from Milpitas to its lower East Bay pipe-line network at Irvington, Calif.

International Plans 8-In. Minnesota Products Line

MINNEAPOLIS.—International Pipe Line, Inc., plans to construct a 132-mile, 8-in. products line from the new 11,500-bbl. International Refineries, Inc., refinery at Wrenshall, Minn., to



Gulf Interstate's Line Fords Green River

Six sideboom tractors lower in a 30-in. gas line across the Green River northeast of Columbia, Ky. Each set of concrete river weights scale 3,750 lb. The line is part of Gulf Interstate Gas Co.'s 860-mile transmission system now under construction from Lake Charles, La., to a point near Ashland, Ky. (H. C. Price Co.)

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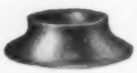

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proposed storage and terminal facilities here.

The project will cost an estimated $4,350,000. The Office of Defense Mobilization, Washington, D. C., has granted the company a quick write-off on 40 per cent of $605,000 for the terminal and storage, 25 per cent of $3,286,000 for the line, and 25 per cent of $439,200 for right-of-way. No accelerated amortization was granted on $19,000 for land.

Competing Firms Reveal Cost Of Gas Lines to Northwest

WASHINGTON.—Competitors for the Pacific Northwest natural-gas market have revealed the cost of their respective pipe-line projects.

Pacific Northwest Pipe Line Corp., which proposes to transport the gas into the new market area from New Mexico and Colorado, estimates its 2,000-mile line will cost about $145,362,496. This is approximately $3,893,759 more than the firm's estimates January 1.

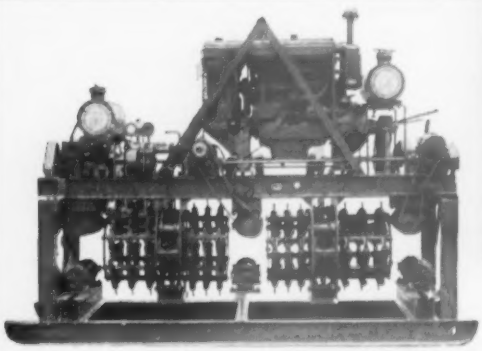
R. D. Ricketts, consulting engineer, told the Federal Power Commission that most of the increase was in main-line facilities. Also, he pointed out some revisions had been made recently in the company's proposed gathering and supply systems.

Westcoast Transmission Co., Ltd., which plans to bring gas from Alberta, Canada, fields to the tri-state Pacific Northwest area, sets cost of its proposed pipe-line system at $138,940,000. Edward T. Herndon of Eastman, Dillon & Co., New York investment bankers, revealed to the FPC that his firm will finance the entire project. He said the financing would be handled through $29,000,000 in 1 to 5½-year serial notes, $70,000,000 in 20-year first mortgage bonds, and $24,440,000 with subordinated long-term debentures and common stock sold to the public.

General American to Erect Storage on New Products Line

TULSA.—General American Transportation Corp. here has been awarded contract to construct tank-storage facilities to handle 1,222,000 bbl. of products along Oklahoma Mississippi River Products Line, Inc., proposed system from Duncan, Okla., to West Memphis, Ark.

The tankage includes 922,000 bbl. at West Memphis, 100,000 bbl. at Conway, Ark., 100,000 bbl. at Ft. Smith, Ark., and 160,000 bbl. at Allen, Okla.



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Has dual head assemblies with opposite rotation of cleaning heads. Independent control of priming head, and pipe input speeds permits proper cleaning of pipe in various conditions. Model MX — 2" to 14"; Model KX — 16" to 26".

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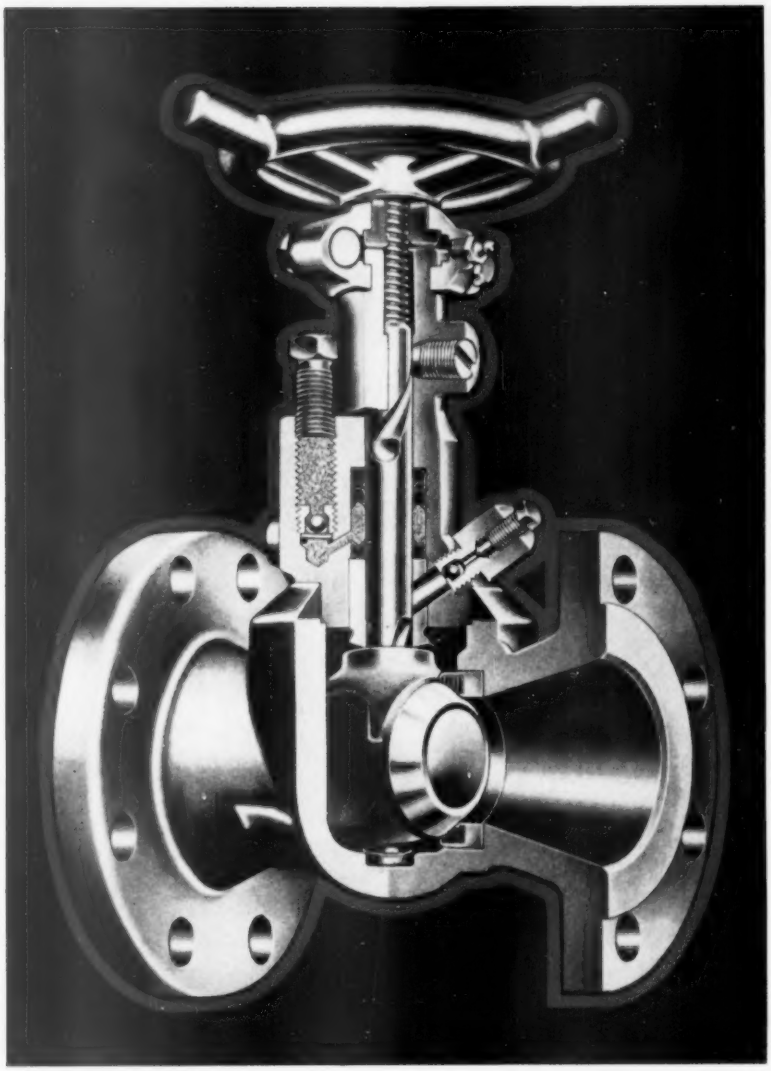

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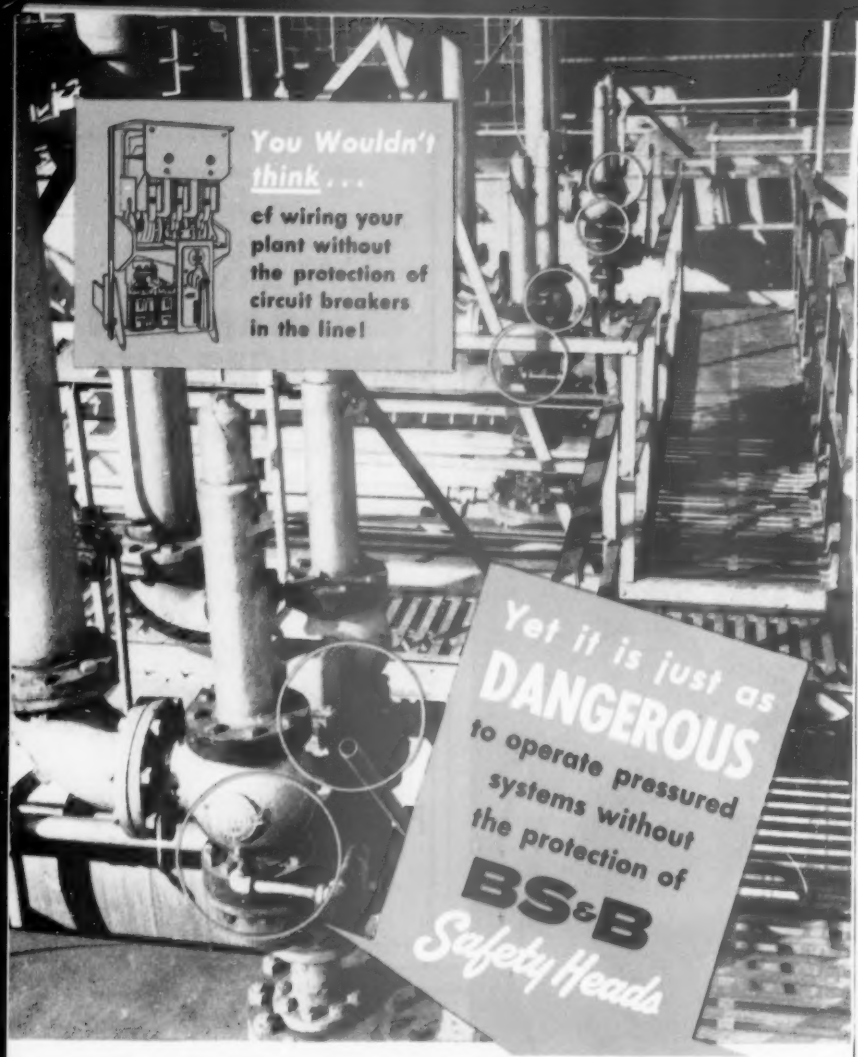
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Also, at these points pumping and loading facilities will be built by River Construction Corp.

River recently was awarded contract to lay the 10 and 12-in. products line between Duncan and the White River in Arkansas, a distance of 400 miles. The remaining 72 miles will be laid by Williams Brothers Co. *(The Oil and Gas Journal, October 19, page 190.)*

R. H. Fulton to Construct 117-Mile Nevada Gas Line

LAS VEGAS.—Contract for Nevada Natural Gas Pipe Line Co.'s 117-mile gas line from Topock, Ariz., to a point near here has been awarded to R. H. Fulton Co.

The proposed line, which will cost about $2,500,000, will supply this area with natural gas from a connection with El Paso Natural Gas Co.'s transmission system at Topock. Construction will get under way next week with completion set for late December.

Originally, Nevada Natural received Federal Power Commission authority to construct the line with 10¾-in. pipe. However, last spring the company petitioned the commission successfully to change the size of the pipe to 12¾ in. Recently, the firm substituted another request to the FPC to change the size of the pipe back to 10¾ in. *(The Oil and Gas Journal, October 12, page 187).*

Southern Plans to Construct, Buy, Sell Georgia Gas Lines

WASHINGTON. — A Federal Power Commission hearing will open this week here on two applications by Southern Natural Gas Co., Birmingham, to construct, buy, and sell pipeline facilities in Georgia.

One application seeks permission to lay about 2 miles of 10¾-in. gas lines parallel to the company's new 16 and 18-in. Macon transmission system from Bass Junction southeastward to a connection with Atlanta Gas Light Co.'s Plant Arkwright tap line. In its other application, Southern proposes to purchase this tap line, which consists of about 1¼ miles of 10¾-in. pipe. Southern has offered Atlanta $13,852 for the line.

In addition, the second application requests that Southern be allowed to sell its Macon tap line consisting of approximately 1,452 ft. of 10¾-in. parallel lines. Also, the company wants to sell a measuring station about a mile from the Macon tap line. Atlanta proposes to buy the facilities for $9,429.

NATURAL GAS

Washington, Potomac Seek FPC Permission to Merge

WASHINGTON.—Washington Gas Light Co. and its subsidiary, Potomac Gas Co., plan to merge, according to a joint application filed by the two firms with the Federal Power Commission.

The companies, which are headquartered here, state that the merger is part of a program to unify Washington and its subsidiaries. Last July two of the company's subsidiaries, Prince George's Gas Corp. and Washington Gas Light Co. of Maryland, Inc., were liquidated. Rosslyn Gas Co., another subsidiary, is expected to be merged into the parent organization shortly.

Washington and its subsidiaries operate in the metropolitan Washington area, including suburban areas in Maryland and Virginia.

FPC Told Wyoming Basin Has More Gas Than San Juan

WASHINGTON. — An independent geologist told the Federal Power Commission here recently that there is more natural gas in Wyoming's Green River basin than in the San Juan basin of New Mexico and Colorado.

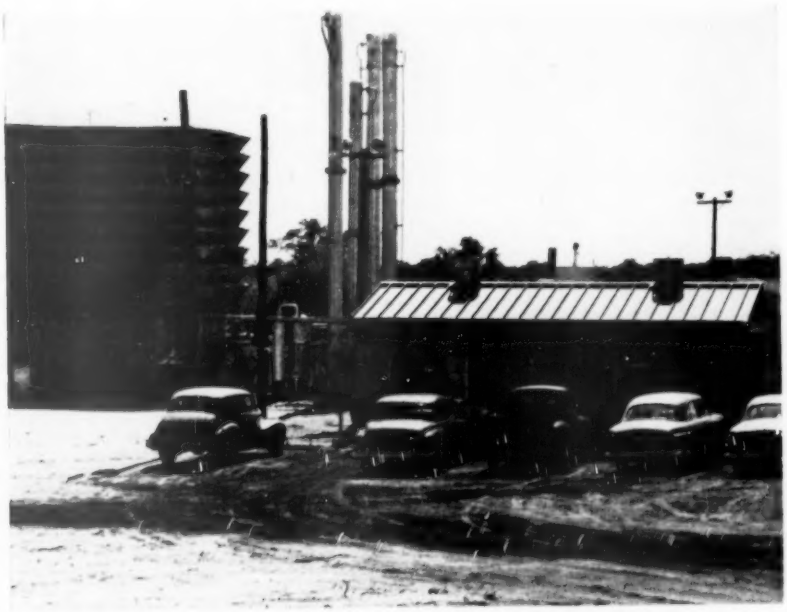
Max L. Krueger of Laramie, Wyo., testified that there are four major sedimentary basins in the Green River area, each as large or larger than the San Juan basin. The testimony was presented at a commission hearing on Pacific Northwest Pipe Line Corp.'s application to supply the Pacific Northwest area with natural gas.

Krueger pointed out that Pacific Northwest would have access to the gas in this new undeveloped region. He added that the pipe-line firm presently has about 1.5 trillion cubic feet of potential gas in the vicinity of Big Piney field.

Two Firms Plan to Increase Gas Deliveries in Missouri

WASHINGTON.—The Federal Power Commission will hold a consolidated hearing here this week on two proposals to supply the Clinton, Mo., area with additional natural gas.

Cities Service Gas Co., Oklahoma City, proposes to construct metering facilities in Johnson County, Missouri, to supply Missouri Public Service Co., Warrensburg, Mo., with the necessary gas. The latter firm plans to transport the gas through a proposed 24.4-mile pipe line to an existing gas system in Clinton.



Central Converts Portable Unit to Permanent Plant

Originally a portable unit, this compact natural-gasoline plant near Coyle, Okla., sits on concrete blocks and is now a permanent installation. The plant, property of Central Petroleum Co., Tulsa, employs dry distillation to produce about 238 bbl. daily of natural gasoline and L.P.G. from 3,000,000 cu. ft. of gas per day. The gas comes from the nearby Central School and Southeast Coyle pools.

Natural Gasoline

Brown & Root Gets Contract For Williston Basin Plant

TIOGA, N. D.—Signal Oil & Gas Co. has let contract to Brown & Root, Inc., Houston, for construction of a natural-gasoline plant near here.

The contractor will install all facilities including fractionating towers, tankage, and interconnecting piping. Construction is expected to start immediately with completion set for next spring.

Presently, Oil Field Service is doing grading and foundation work, and Kelly-Coppedge is constructing an office and laboratory for the plant. Also, Williams Brothers Co., Tulsa, is completing 150 miles of field pipe lines connecting Amerada Petroleum Corp.'s production in Beaver Lodge and Tioga fields with the plant site.

Under a previous agreement, Signal and Amerada each would have an interest in the $15,000,000 project. Amerada is to supply the plant with 65,000,000 cu. ft. of gas per day, and receive all residual dry gas for domestic and industrial use. Signal will operate the plant and market its production, which will consist of about 3,571 bbl. of natural gasoline and L.P.G., and 41 tons of sulfur daily *(The Oil and Gas Journal, March 30, page 214)*.

New Way to Convert L.P.G. To Gas Substitutes Studied

CHICAGO.—A new method of converting natural gasoline and other liquefied petroleum gases into natural-gas substitutes is in the pilot-plant stage at the Institute of Gas Technology here.

It is reported that propane and butane can be used along with natural gasoline as starting materials for the process. The pilot-plant operation is being sponsored by East Ohio Gas Co., which anticipates utilizing the gas-making system commercially.

The chemists, who are working on the new process, claim that in addition to gas substitutes, substantial quantities of benzene, toulene, xylene, and styrene can be obtained.

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REFINING

Units on Stream

Sinclair adds 35,000 bbl. to refinery's capacity

HOUSTON.—A group of new units went on stream at Sinclair Refining Co.'s refinery here last week increasing the installation's crude-charging capacity from 90,000 to 125,000 bbl. per day.

The new facilities include a 50,000-bbl. fluid catalytic cracking unit, a crude and vacuum still, additional vacuum stills, a 600-lb. boiler and associated treating equipment, water clarifier, and miscellaneous plant-treating units. The expansion project cost about $35,000,000.

Cracking unit . . . The cat cracker, which was designed by Sinclair engineers and constructed by C. F. Braun & Co., processes 9,680 bbl. of recycle charge in addition to its fresh feed to produce 14,760 bbl. of light gasoline, butane-butylenes, propane-propylenes, heavy reform gasoline, and light and heavy gas-oil. The unit has built into it an unusual type of steam-generating plant which recovers waste gases.

Crude unit . . . The crude unit, designed and built by Fluor Corp., charges about 62,000 bbl. daily of crude. Primarily, its daily output consists of 14,000 bbl. of heavy gas-oil, 12,000 bbl. of stabilized gasoline, and 3,800 bbl. of lube-oil distillates.

All of the new units enable the refinery to double its aviation-gasoline production. The refinery now can turn out approximately 5,000 bbl. daily of aviation fuel plus other military fuels. In addition, about 2,000 bbl. per day of feed stock for the manufacture of synthetic rubber will be delivered to government-owned rubber plant here.

New Coking Processes to Be Presented at A.P.I. Confab

CHICAGO.—The Refining Division of the American Petroleum Institute will sponsor a two-paper session on two new continuous processes for coking heavy residual fractions at its annual meeting here November 9.

A. Voorhies, Jr., Esso Standard Oil Co., Baton Rouge, and H. Z. Martin, Standard Oil Development Co., Linden, N. J., will present the first detailed technical information on their new process in a paper entitled "Fluid Coking of Residua."

Further information will be revealed on Lummus Co.'s continuous contact coking process in a second paper by Valentine Mekler, A. H. Schutte, and T. T. Whipple. This process is in operation in a unit at the Sunray, Tex., refinery of Shamrock Oil & Gas Corp. Fluid cokers are planned for three domestic Jersey Standard refineries. These are Carter's refinery at Billings, Mont., and Esso's refineries at Baton Rouge and Baltimore.

Bids Opening Set

Military needs 28,667,000 bbl. of avgas, jet fuel

WASHINGTON.—The Armed Services Petroleum Purchasing Agency will open bids next week on needed oil fuels to fulfill military requirements for the first half of 1954.

Aviation fuel requirements will total some 12,667,000 bbl. of avgas and 16,000,000 bbl. of jet fuel. The former figure includes 7,073,500 bbl. of 115/145 grade, 3,961,200 bbl. 100/130 grade, 1,504,000 bbl. 91/96 grade, and 137,900 bbl. 80-grade gasoline. Jet fuel needs include 643,300 bbl. JP-3, 15,363,200 bbl. JP-4, and 11,900 bbl. JP-5 jet fuel. These quantities are in addition to supplies now under contract for delivery next year and include 212,000 bbl. of 115/145 grade, 5,300 bbl. of 80-grade gasoline, and 7,448,500 bbl. of JP-4, which are to be purchased on a spot basis during the period.

. . . Other requirements are: 4,500,000 bbl. Navy special fuel oil, excluding the West Coast; 7,000,000 bbl. Navy Special, exclusive of the U. S. Gulf, East Coast, and Caribbean area; 1,155,000 bbl. 50 cetane diesel fuel, excluding the West Coast; 2,000,000 bbl. 50 cetane diesel fuel, exclusive of the Gulf, East Coast, and Caribbean area; 690,000 bbl. 35 cetane diesel fuel; 1,035,000 bbl. low pour, minus 70° pour point diesel fuel; 690,000 bbl. low pour, minus 40° pour point diesel fuel; and 750,000 bbl. of No. 6 fuel oil, exclusive of the West Coast.

For that portion of these requirements which is required for shipment to the West Coast, or to points normally supplied from the West Coast, bids are being solicited from suppliers in all areas. Contracts will be consid-

ered on the basis of the lowest laid-down cost to the Government.

...**Bids** are being solicited from West Coast, East Coast, Gulf, and Caribbean suppliers for 4,500,000 bbl. of Grade 80/88 combat automotive gasoline. Also, these contracts will be awarded on basis of lowest laid-down cost.

Refining Briefs

LOS ANGELES.—Construction has been started on a 15,000-bbl. capacity Thermofor catalytic reformer at General Petroleum Corp.'s Torrance refinery. Completion of the $9,000,000 unit is scheduled for July 1954.

HANFORD, Calif.—Caminol Co., which operates a 5,000-bbl. refinery here, has announced it will add a new polymerization unit as part of a $200,000 expansion program. The plant has a 1,000-bbl. cracking unit.

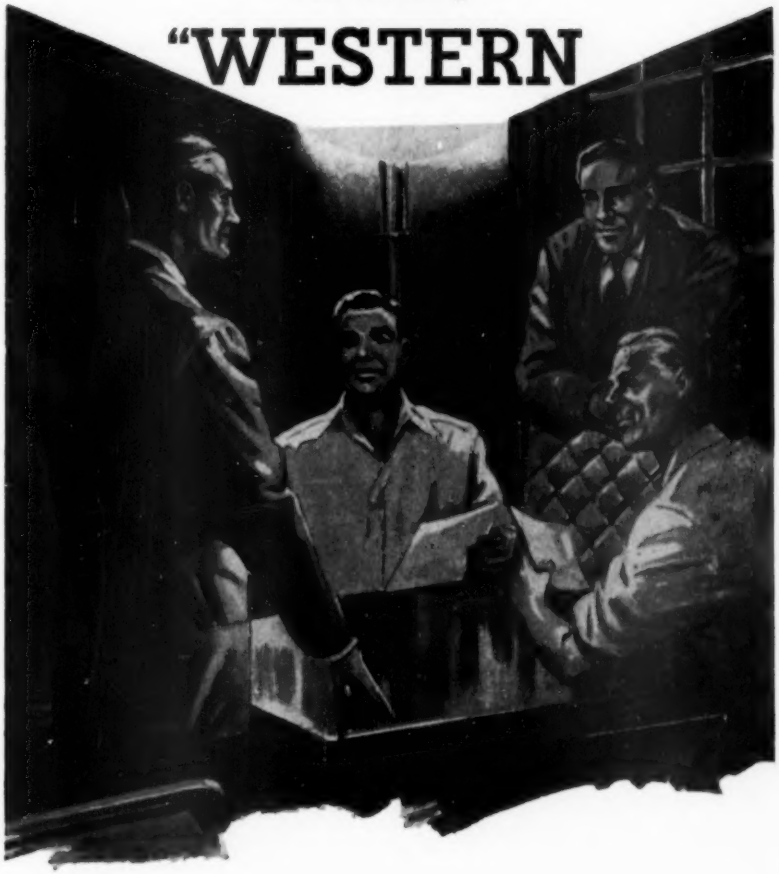
BAKERSFIELD, Calif. — Douglas Oil Co. is preparing to start construction of a 2,500-bbl. catalytic reformer at its 8,000-bbl. refinery here. The unit will be of the type licensed by Atlantic Refining Co. and is to be erected by Ralph M. Parsons Co., Los Angeles. A portion of the feed stocks will be supplied by an existing 5,000-bbl. thermal cracking unit. Completion of the new unit is expected by about next February.

BAKERSFIELD, Calif. — Mohawk Petroleum Corp. has awarded contract for erection of a 2,500-bbl. Atlantic-type catalytic reformer to Ralph M. Parsons Co., Los Angeles. Construction of the unit, which will cost about $600,000, is scheduled to start in January. It is to be erected at Mohawk's 11,000-bbl. refinery here, which has a thermal cracking capacity of 3,800 bbl.

NEW YORK.—Lummus Co. here has been authorized to offer the new Shell hydrodesulfurization process. The catalytic process features ability to desulfurize heavier charge stocks, and will permit long on-stream periods. The process is applicable for upgrading high sulfur stocks and catalytic cracked gas oils to diesel fuel grade. It also promises effective removal of nitrogen from shale and tar-sand oils.

NEW YORK.—Pan American Refining Corp. has renewed for 1953-54 five fellowships in chemistry and chemical engineering at Illinois, Massachusetts Institute of Technology, Rice, Kansas, and Texas. A sixth fellowship was added this year at Arkansas.

WHEN THEY SAID HEAT EXCHANGERS HE SAID, "WESTERN



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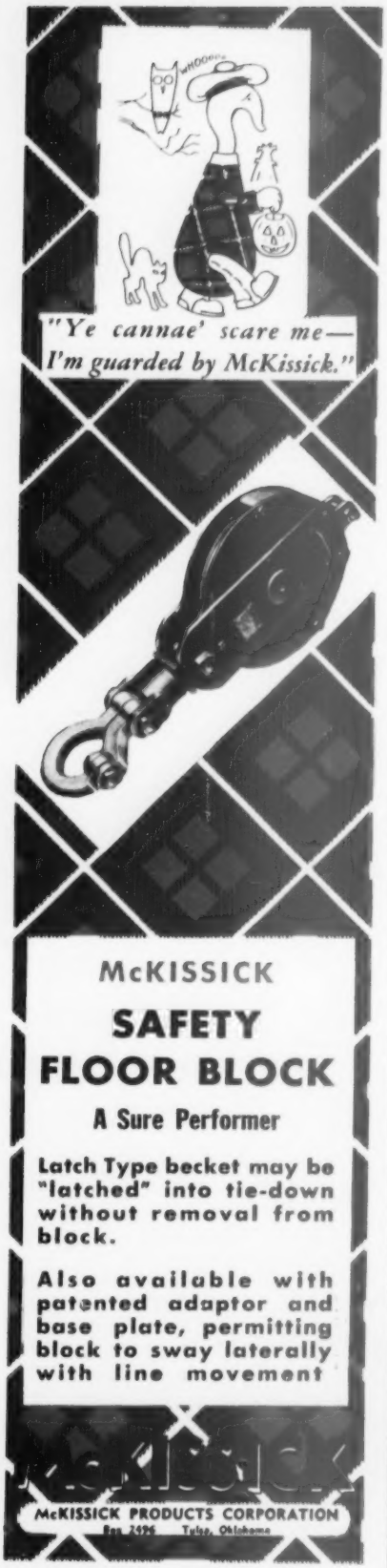
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Among the Drilling Contractors

Drilling Upturn Boosts Rigs to New 1953 High

Drilling activity in the United States and western Canada during the week ended October 19 climbed to a new high level for the year with 2,930 rotary rigs reported in operation. This was an increase of 50 over the number of rigs reported running the previous week, and a gain of nearly 200 rigs within the past 2 months.

The present number of rigs now is within 100 of equaling the 1952 record of 3,032 rigs reported active the middle of last December. With 180 more rigs running the past week than there were during the corresponding week last year, and the number steadily increasing as it normally does at this time of year, prospects are that the 1952 peak number of active rigs will be greatly exceeded this year.

Drilling in the Rocky Mountain region increased to a new record high level with 295 rigs reported running during the week, 7 more than were listed the previous week.

ACTIVE ROTARY RIGS*

Area—	Week ended 10-19-53	Change week ended 10-12-53	Change week ended 10-20-52
Gulf Coast	594	+19	+ 1
N. & W. Tex.-N. M.	834	+19	+ 57
Ark.-N. La.-E. Tex.	182	— 8	+ 28
Oklahoma	366	+13	+ 53
Kansas-S. Nebraska	163	0	— 8
Illinois-Eastern	164	+11	+ 22
Rocky Mountains	295	+ 7	+ 35
Pacific Coast	162	— 4	— 5
Total U. S.	2,760	+57	+183
Western Canada	170	— 7	— 17
Total	2,930	+50	+166

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States, and the Gulf Coast and Arkansas-North Louisiana-East Texas areas are shown on pages 197 and 198.

Jett Drilling Co. has a contract with Sun Oil Co. for a 7,000-ft. test to be drilled at 1 Guy, in 18-4n-9e, 7 miles east of Summit, in northeastern Pike County, southern Mississippi. This will be Sun's second test in the area.

C. G. Davis Drilling Co., Stephens, Ark., has a contract with Harris H. Pace and associates, of Camden, Ark., for a Travis Peak test to be drilled on the west side of Smackover field, in Ouachita County, Arkansas. Location is for 1 Louis Werner Saw Mill, in the C SW SW 26-15s-17w. Objective is around 3,800 ft.

Gene Reid Drilling, Inc., Bakersfield, Calif., has contracted with Harry H. Magee, of Oakland, Calif., for two extension tests to be drilled in the

FAMILY AFFAIR . . . A father, W. C. Perry (left end), and his two sons, Fred and Jerry (middle in order), make up three members of this four-man drilling crew on a rig Langford Drilling Co., of Wichita Falls, is operating for DeSoto Oil Co. in the Anson area of Jones County, North Texas. The father is the driller; the sons are helpers. K. B. Herndon (right) is the fourth member of the crew.

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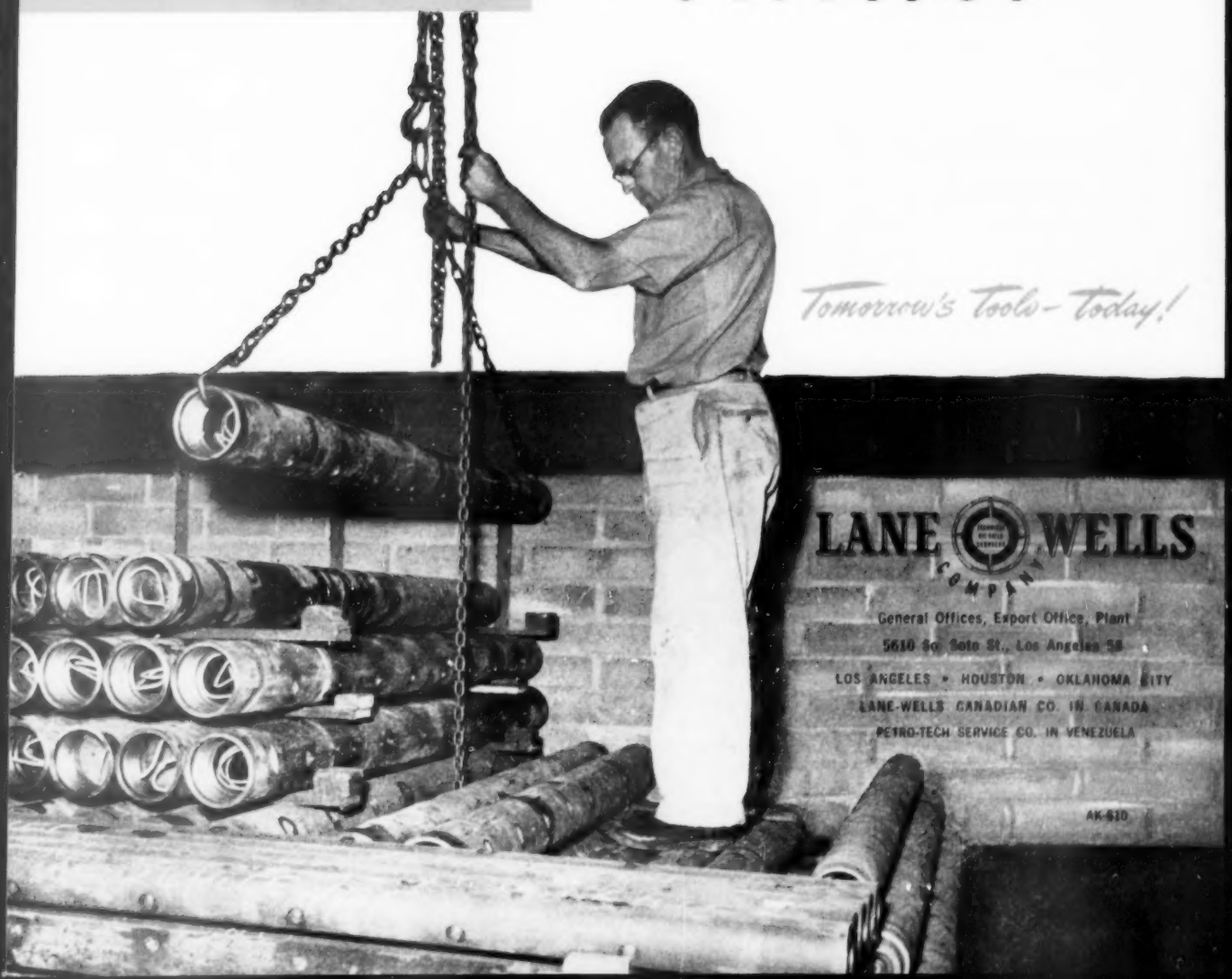
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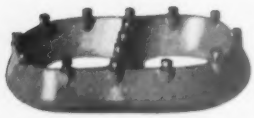

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Moffatt gas area, Madera County, California. Tests are listed as 1-1 and 2-11 Stone, both in 11-12s-14e.

Circle Drilling Co., Lake Charles, La., has a rig working for Bates & Cornell on a 7,200-ft. test, 1 Welsh Unit 1, at Welsh dome, in Jefferson Davis, southern Louisiana. Location is in 22-9s-5w.

Southwestern Workover Co. is drilling Pan American Production Co.'s third test on its 1,160-acre Brown lease, 2 miles southeast of Mathis, in San Patricio County, South Texas. Contract is for 5,500 ft. The two previous tests were dry.

Grey Wolf Drilling Co., Houston, is drilling for Fidelity Oil & Royalty Co. at 1 Shivers, a projected 6,000-ft. wildcat test, located a mile northeast of Tynan, in Bee County, South Texas. Spot location is in Section 104, George H. Paul Subdivision of the Welder Ranch.

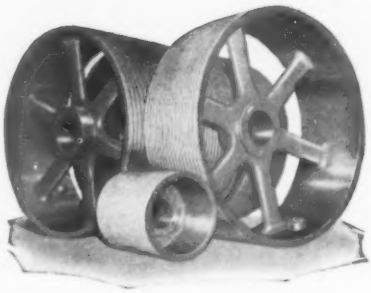
Clyde Hall Drilling Co., Bakersfield, Calif., is making hole on a 5,500-ft. test it is putting down for MJM & M Oil Co. at 1 Hall, in 4-30-29, north of the Graham pool, in the Edison area, east of Bakersfield, in Kern County, California.

Greyhound Drilling Co., Shreveport, has a new wildcat operation under way 3¼ miles southwest of Fouke, in Miller County, southwestern Arkansas. The test, 1 Fouke estate, in the E½ SW SW 31-17s-27w, is being drilled for George Greer and Jay Simmons, of Dallas. Contract depth is 5,200 ft.

Vasser Drilling Co., Natchez, Miss., has contracted with Carter Oil Co. for a 7,200-ft. wildcat test to be drilled in the Ashland area of Concordia Parish, East Central Louisiana. The new test, 2 Frank Whorton, in 25-4n-9e, is about 2 miles northeast of the townsite.

El Dorado Pipe & Supply Co., El Dorado, Ark., has contracted for the drilling of a wildcat test for J. D. Reynolds Co., of Camden, Ark. The test, 1 Arnold-Usrey, is located in the NW SW SE 36-15s-15w, about 1½ miles east of Smackover field, in Ouachita County, Arkansas. It will be carried to the Travis Peak formation around 3,300 ft.

Greyhound Drilling Co., Shreveport, is drilling on a 4,400-ft. Glen Rose test, 1-A Flores estate, 2¼ miles west of the Grogan field, in DeSoto Parish, northwestern Louisiana. Operator is Lawton Oil Corp., of Magnolia, Ark.



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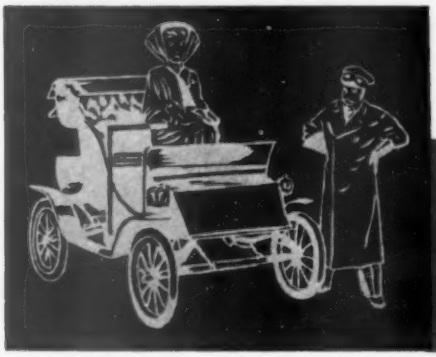

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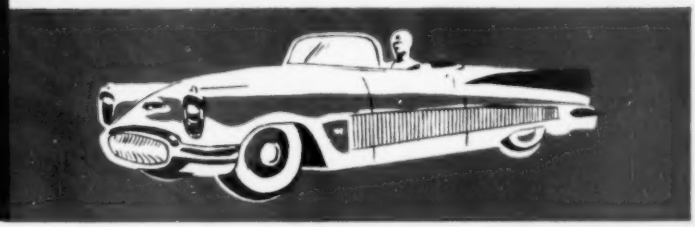

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EXPLORATION

More Oil Will be Found Near Wichitas

by Philip C. Ingalls

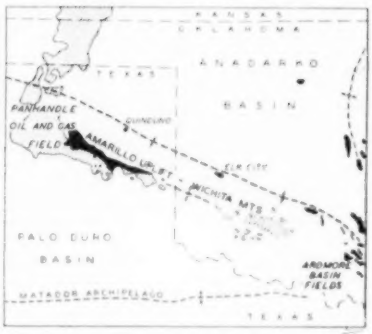
THE basin areas immediately adjacent to the Wichita Mountains of southwestern Oklahoma and the buried Amarillo range of the Texas Panhandle are among the most promising undeveloped areas of the Mid-Continent region.

The Wichitas, composed chiefly of granite, rise more than 1,000 ft. above the plains of western Oklahoma which are developed on essentially flat-lying Permian rocks. The Amarillo range has only minor expression on the surface. Its highest peaks, which are topped about 2,000 ft. below the surface, are flanked by late Pennsylvanian "granite wash" (deposits of granite conglomerate, arkose, and a mixture of decomposed and disintegrated igneous and fragments of sedimentary rocks) and are overlain by Permian dolomites.

The Amarillo-Wichita mountain system came into being in early Pennsylvanian time, subsequent to the deposition of the Morrow series. The range was stripped of its older Paleozoics while the Deese and early Hoxbar sediments were being deposited in the Anadarko and Ardmore basins. In late Hoxbar time the system was further uplifted resulting in the deposition of granite wash across the beveled edges of the older Paleozoics. Subsidence of the area permitted deposition of uppermost Pennsylvanian and Permian rocks until all but the now-exposed peaks of the Wichitas were blanketed.

The narrow belts of beveled edges of pre-Hoxbar Paleozoics and the overlying granite wash on the flanks of the Wichita system set up perfect traps for oil accumulation. It is unfortunate for the geologist that these rocks do not restrict their attitudes to the simple picture presented above. Actual conditions are chaotic. Extremely complex folding and faults with displacements of more than 10,000 ft. have been indicated in the sedimentaries flanking the mountains as a result of thrusts and crustal shortening. To further complicate prospecting, this area, for the most part, does not respond to seismic studies.

Essentially all of the oil production related to the Wichita system that has been developed to date is restricted to the northern flank of the 200-mile-long uplift. From west to east the producing areas are:



Suthwestern Oklahoma and the Texas Panhandle are promising areas for future development.

1. The 80-mile-long Panhandle field which has an estimated ultimate recovery of 1 billion barrels of oil.

2. Last year's Roberts County discovery, Quinduno field, the first Permian discovery in the Texas Panhandle since the last of the many pools of Panhandle field was opened in 1926. This field now has more than 60 producing wells, all of which are completed in the Permian but one, which produces from granite wash.

3. Elk City, a 1948 discovery based on seismic work carried out in an "island" of fair reflections. This field now has nearly 300 wells producing about 18,000 bbl. of high-gravity oil daily, chiefly from the granite wash. Two wells in the field are completed in the deeper Des Moines series.

4. Other production along the north flank of the Wichitas is relatively unimportant, but it is very significant that oil has been developed in the Springer formation, the prolific early Pennsylvanian sand of the Ardmore basin and the southeastern end of the Anadarko basin immediately to the west of the Golden Trend.

There has been no oil found in the Palo Dura basin and only unspectacular fields within its eastward extension into Oklahoma where it is known as the Hollis basin.

Despite their complexities, the flanks of the Wichitas are believed to offer excellent prospects for more big oil fields. The few far-apart producing areas developed to date are positive indication that there must be many more sizable accumulations in the same or deeper stratigraphic positions within this extensive province.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

FLORIDA . . . Commonwealth Oil Co. 1 N. B. Wiseheart-State of Florida, 16-54s-35e, 40 miles west of Miami, continues to find oil shows in cores. On previous drill-stem test at 11,314-47 ft. the wildcat recovered 2,185 ft. of 20.9°-gravity oil and 270 ft. of salt water. Coring continues.

WYOMING . . . Argo Oil Corp is completing a new pay discovery in the Big Horn zone (Ordovician) in Hamilton Dome field, Hot Springs County. The 51 Government, C SE SE 14-44n-98w, is the first production from the Ordovician in Wyoming. The well swabbed 500 bbl. of 13°-15°-gravity oil daily.

NORTH DAKOTA . . . Amerada Petroleum Corp. has an indicated Devonian discovery at 3 Hanson, C SW NW 18-158n-94w, Mountrail County in the center of Tioga field. Recovery on a drill-stem test at 9,913-10,020 ft. was 56 bbl. of brownish-black, sulfurous, gas-cut, congealed 36°-gravity oil.

UTAH . . . Carter Oil Co. recovered 3,678 ft. of free oil and 150 ft. of mud-cut oil on drill-stem test at 4,520-4,600 ft. at 1 Nielson, NE SE NW 36-3s-5w (USM), Duchesne County. The Green River strike confirms County pool, opened earlier this year.

Wildcat Completions, September 1953

	Total	Oil	Gas	Dry	Footage	1953 Total comp.	1953 Cum. (1,000 ft.)	1952 Total comp.	1952 Cum. (1,000 ft.)
Kansas	69	3	3	63	266,783	681	2,571	663	2,589
Oklahoma	60	16	1	43	293,563	596	2,610	562	2,631
Texas	475	91	7	377	2,368,907	4,059	19,888	3,620	17,423
North Central	183	45	2	136	653,942	1,651	5,882	1,602	5,434
West	93	25	0	68	572,305	670	4,003	650	3,829
Panhandle	1	0	0	1	4,475	20	103	51	330
East	33	3	1	29	183,570	235	1,191	179	993
Gulf Coast	70	9	1	60	503,054	674	4,831	528	3,993
Southwest	95	9	3	83	451,561	809	3,878	610	2,844
Louisiana	55	15	2	38	481,060	381	3,387	287	2,510
North	20	0	0	20	115,504	121	715	129	758
South	35	15	2	18	365,556	260	2,672	158	1,752
Mississippi	11	0	0	11	81,411	150	1,070	139	1,012
Arkansas	16	1	0	15	44,826	99	335	72	309
Nebraska	16	1	1	14	85,551	125	640	123	524
Rocky Mountain	58	10	1	47	290,962	499	2,795	344	1,812
Dakotas	13	0	0	13	53,233	69	373	29	196
New Mexico	16	3	1	12	96,552	119	788	123	805
California	59	6	0	53	229,263	495	2,386	445	2,047
Tri-States	87	3	0	84	170,554	736	1,455	1,011	2,113
Others	41	1	3	37	162,178	360	1,242	396	1,117
Total September 1953	976	150	19	807	4,624,843	8,369	39,540	7,814	35,088
Total August 1953	970	136	37	797	4,693,068				
Cumulative 1953	8,369	1,223	288	6,858	39,539,667	8,369	39,540		
Cumulative 1952	7,814	1,144	202	6,468	35,088,396			7,814	35,088

Third-Quarter Wildcat Completions Show Gain

by John C. McCaslin

THIRD-QUARTER wildcat completions show a 7 per cent gain over 1952, while total exploratory footage drilled is up 12 per cent over last year. September wildcat completions were on an even keel with the previous month. In order to reach the 11,371 wildcats forecast for completion this year, operators must complete about 1,000 tests monthly during the last quarter.

Successful wildcat discoveries in the Rocky Mountain area have passed the 100 mark for the first 9 months of this year. Only 96 new strikes were made in the entire year of 1952. The total includes 75 oil pools or new pays and 25 gas fields. Colorado leads the region with 22 new oil strikes and 9 gas discoveries. Wyoming runs second with 18 new oil-producing and 1 new gas field. Western Nebraska is tied with Wyoming with 18 new strikes, while Montana reports 12 new pools. Colorado's Little Beaver-Badger Creek area continues to be the region's fastest-growing new wildcat testing ground.

Only five areas reported increases in wildcat completions during the month. The biggest increase was in Texas, while Louisiana, Arkansas, Nebraska, and the Dakotas all reported slight gains. Important developments on the northeastern rim of the Anadarko basin and in the Williston basin highlighted the month's activity.

New Simpson strikes . . . Oklahoma and Kansas both reported significant Simpson sand strikes, taking first place in exploratory interest in the Mid-Continent area for the second straight month. Champlin Refining Co. 1 Diamond in Woods County, Oklahoma, appears to be an important Simpson and Arbuckle discovery. The Simpson oil flow was estimated at 60 bbl. per hour on tests, while up to 9,980 M.c.f. of gas per day was gaged on tests of the Arbuckle. The well has been completed for 25½ bbl. of oil per day in the Arbuckle.

The discovery is located 60 miles from the nearest Oklahoma production at Ringwood field on the northeastern rim of the Anadarko basin. It is located 12 miles southwest of nearest Kansas production in Barber County. Successful completion of this strike has made one of the most important discoveries in Oklahoma this year, opening first production in Woods County, which is in an essentially productionless area of the Anadarko basin.

The new Simpson discovery in Kansas is The Texas Co. 1 Graber in Kingman County. On final flow test the well made 403 bbl. of 43°-gravity oil in 11½ hours through ⅝-in. choke. The flowing Simpson strike is 9 miles southeast of Basil pool, and about 45 miles north of the recently opened North Jarvis-Simpson oil pool in Grant County, Oklahoma. These three recent Simpson discoveries give encouragement for further exploitation of the potentialities of the Ordovician-Simpson sands on the northern shelf of the Anadarko basin and the southern end of the Sedgwick basin.

Williston basin . . . A new producing formation has been indicated for the North Dakota portion of the basin at Amerada Petroleum Corp. 1 Logan, a northwest offset to Amerada's recent Fryburg Madison discovery in Billings County. The 1 Logan recovered more than 1,200 ft. of black oil from the Mississippian-Heath on drill-stem test, and went on to test the Madison.

The Heath is the youngest formation of the Mississippian-Big Snowy group which overlies the Madison group in the central portion of the Williston basin. This is the first well in North Dakota to recover oil from the Heath, and if completed, it will be the first commercial sand production in the state. The only other Heath oil recovered in the basin was in Montana's East Poplar field.

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Last Quarter to Set New Record

by John C. McCaslin

TOTAL completions in the United States for the first 9 months of 1953 show a 5 per cent gain over the previous year, promising that the last quarter of the year will bring the score up to another record for the industry. September total completions were up 3 per cent over the previous month.

The industry is setting another footage record this year. More than 148 million feet of hole has been dug so far this year. The depth—classification totals show a decline only in the 7,500-10,000-ft. class. This decline is due to the sharp drop in West Texas well completions this year. The most substantial increases are noted in the 5,000-7,500 and over 12,500-ft. classes.

Eleven areas reported substantial gains over the previous month. Texas operators completed more than 1,500 wells in September, up considerably over August. Completions in Kansas and Oklahoma remain at high levels, with Oklahoma totals up 26 per cent over last year. More than 1,000 wells were completed during the third quarter of this year in the Rocky Mountain region, bringing the total of completions in this area to over 2,300 wells for the first 9 months of 1953. Completions in the area totaled only 2,300 for the entire year in 1952. Wildcat completions in the region are up 45 per cent over last year.

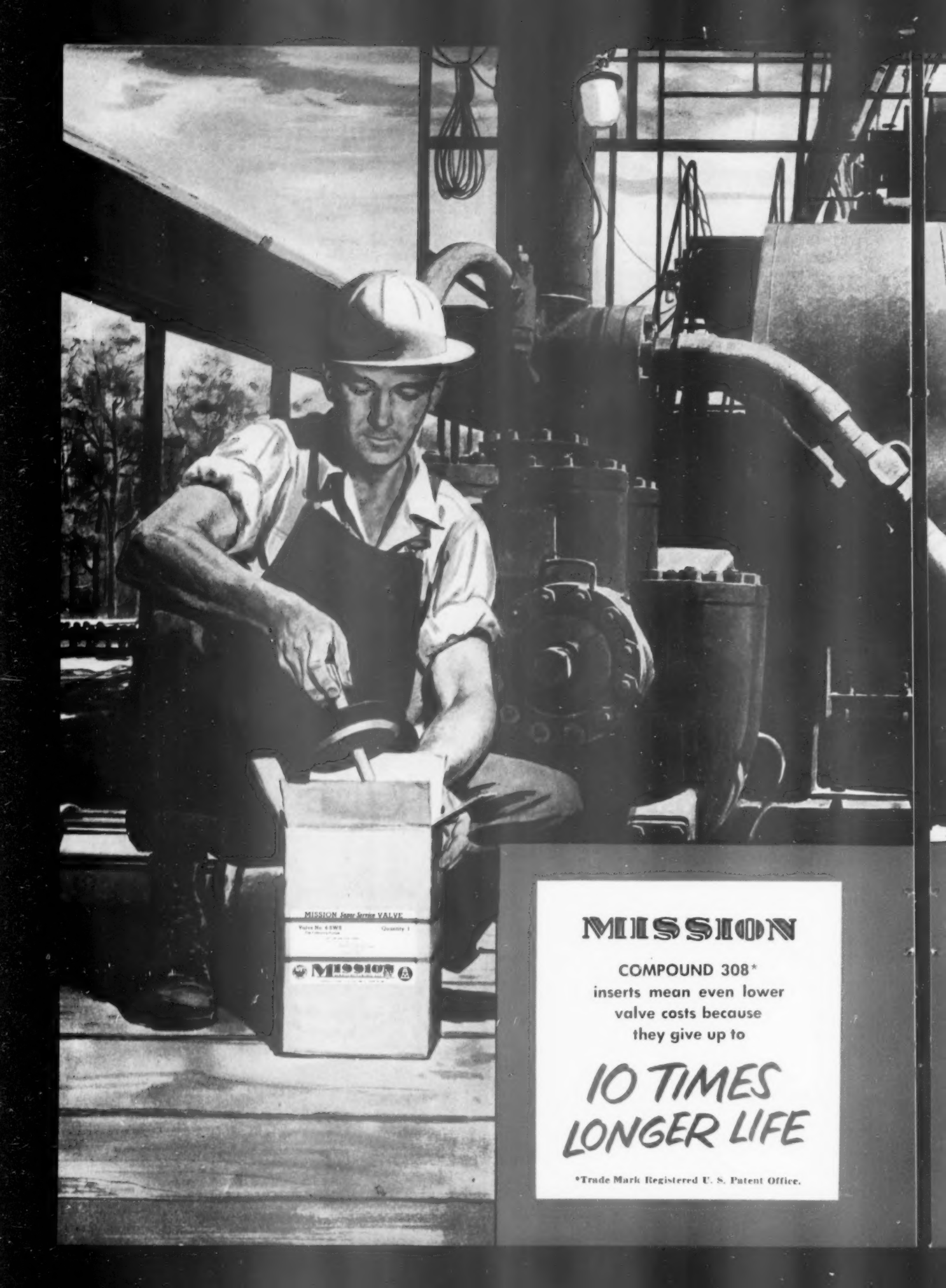
The California Co. staked two new locations in the Black Hollow area of Weld County, Colorado, following successful tests at the confirmation well to the Permian discovery there. The Permian strike at Black Hollow produced 304 bbl. of oil per day on the pump from the Lyons sand. The increased search for pre-Cretaceous production in the Denver-Julesburg basin began after the initial discovery in Keota field last winter.

First oil production for the general Pistol Ridge-Maxie field area in southern Mississippi's Pearl River County was reported at American Liberty Oil Co. and I. P. LaRue 1 Hatten, 1-1s-14w, about 1½ miles northwest of Pistol Ridge field. The discovery opens oil production in a gas-condensate area. The well flowed at the rate of 144 bbl. of oil per day through 6/64-in. choke from perforations in the Eutaw sand at 7,416-21 ft. Pistol Ridge field has four producing gas-condensate wells from the Wilcox and Tuscaloosa sands, and has indications of being a major gas-condensate reservoir.

SUMMARY OF COMPLETIONS, SEPTEMBER 1953

	Total comp.	Oil	Gas	Dry	Under 2,500 ft.	2,500-5,000 ft.	5,000-7,500 ft.	7,500-10,000 ft.	10,000-12,500 ft.	Over 12,500 ft.	Total footage	Rigs and drilling
Ala.-Ga.-Fla.	15	0	0	15	1	5	6	1	1	1	93,908	16
Arkansas	66	33	0	33	20	34	12	0	0	0	219,134	68
California	217	148	3	66	54	102	34	16	8	3	896,064	256
Colorado	62	27	0	35	4	5	50	3	0	0	326,196	89
Illinois	195	99	0	96	85	110	0	0	0	0	479,387	396
Indiana	112	40	0	72	99	13	0	0	0	0	179,583	156
Kansas	361	167	31	163	44	309	8	0	0	0	1,233,028	362
Kentucky	82	34	0	48	67	15	0	0	0	0	157,154	154
Louisiana	262	156	14	92	64	33	36	53	58	18	1,796,292	357
North	115	63	10	42	62	20	22	8	3	0	401,715	142
South	147	93	4	50	2	13	14	45	55	18	1,394,577	215
Michigan	48	17	1	30	30	15	3	0	0	0	116,428	136
Mississippi	30	11	1	18	0	3	20	4	3	0	206,420	45
Montana	45	22	1	22	23	9	8	5	0	0	162,968	84
Nebraska	32	13	1	18	3	18	11	0	0	0	165,486	34
New Mexico	137	59	55	23	26	35	44	11	15	6	785,390	230
New York	60	35	0	25	60	0	0	0	0	0	82,100	53
North Dakota	17	6	0	11	0	10	0	6	1	0	96,965	46
Ohio	106	38	24	44	61	45	0	0	0	0	216,092	185
Oklahoma	625	377	29	219	204	296	90	30	5	0	2,178,482	1,104
Pennsylvania	175	68	23	84	152	5	18	0	0	0	268,493	150
Texas	1,556	879	91	586	368	543	398	187	44	16	7,394,729	1,134
North Central (7-B & 9)	575	329	5	241	235	227	109	4	0	0	1,951,130	292
West (7-C & 8)	372	267	2	103	43	131	107	53	25	13	2,131,405	342
Panhandle (10)	66	40	19	7	8	57	0	0	1	0	216,621	55
East (5 & 6)	66	19	8	39	3	18	33	10	2	0	389,125	72
Gulf Coast (2 & 3)	229	111	30	88	12	38	81	84	13	1	1,545,554	223
Southwest (1 & 4)	248	113	27	108	67	72	68	36	3	2	1,160,894	150
Utah	3	1	0	2	0	0	3	0	0	0	17,476	38
West Virginia	47	8	32	7	23	21	3	0	0	0	135,074	175
Wyoming	77	52	5	20	12	31	28	6	0	0	370,702	299
Miscellaneous	§3	0	0	3	1	1	1	0	0	0	10,170	¶14
Total September 1953	4,333	†2,290	311	*1,732	1,401	1,658	773	322	135	44	17,587,721	‡5,581
Total August 1953	4,202	2,128	370	1,704	1,334	1,615	766	319	125	43	17,039,619	5,011
Cumulative 1953	36,404	18,864	2,853	14,687	11,076	14,896	6,384	2,664	1,057	327	148,211,240	
Cumulative 1952	34,774	18,213	2,423	14,138	10,679	13,900	6,159	2,747	1,032	257	142,692,505	

*Incl. 62 service wells: Kans. 10, N. Y. 25, Ohio 5, Okla. 10, Pa. 5, N. Tex. 2, W. Tex. 5. †Incl. 31 condensate wells: S. La. 10, Miss. 1, Okla. 2, W. Tex. 3, Gulf Coast 10, S.W. Tex. 5. ‡Incl. all wells rigged up and/or drilling at month end. §Incl. 3 S. D. ¶Incl. Md. 3, S. D. 3, Nev. 7, Idaho 1.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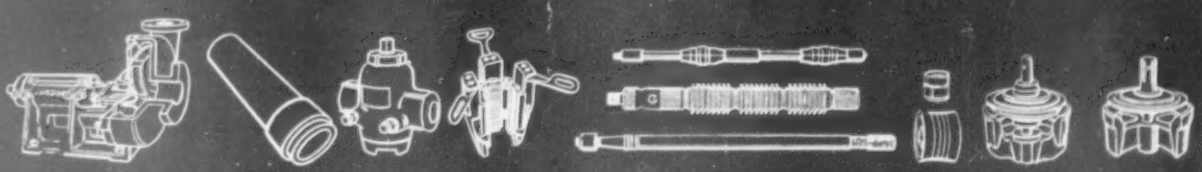


TEXAS

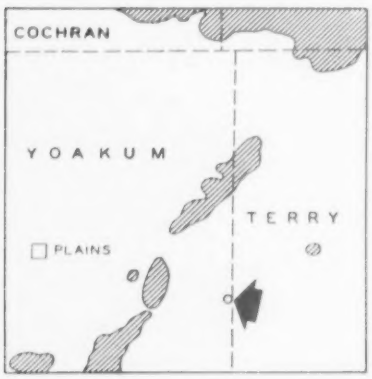
WEST TEXAS

Deepening Job in Yoakum County Has Wolfcamp Oil

J. C. Barnes, Williamson & Bruner 1 Turrentine, an old dry hole at 7,920 ft., re-entered and projected to 13,000 ft., found a structural high on the Wolfcamp and made a flush flow of oil on first drill-stem test.

The discovery entered the Wolfcamp at 9,690 ft. on elevation of 3,303 ft. and tested between 9,879-9,963 ft. Gas showed in 6 minutes and oil in 18 minutes, which was allowed to flow into pits for 30 minutes at an estimated 60-80 bbl. an hour. Gravity of the oil was 48° and recovery in the pipe was clean oil with no shows of water. Flowing pressure ranged to 3,250 psi.

Another source placed the minus datum point on the Wolfcamp at 6,187 ft., or 450 ft. high to Placid Oil Co. 1 Brownfield, 4 miles southeast. Location is in 41-K-PSL Survey, 16 miles east of Plains, and 5 miles east of San Andres production in Ownby field.



Place-fix map showing J. C. Barnes, Williamson & Bruner 1 Turrentine in southeast Yoakum County, which made a high flow of oil from the Wolfcamp of lower Permian age. Shaded areas are San Andres production, of middle Permian age, and field names from southwest to northeast are Waples-Platter, Ownby (nearest discovery), Prentice, and south end of the big Slaughter pool in Cochran and Hockley counties.

Deep Prospect in Southeast Crane County

Humble Oil & Refining Co. 5 Cowden, in 25-X-CCSD&RGNG Survey, logged several good oil shows over a 278-ft. Devonian section. Drill-stem tests and recoveries were: From 8,600-47 ft. recovery was 50 ft. of gas-cut mud and 260 ft. of oil and gas-cut mud. From 8,647-67 ft. recovery was 60 ft. of oil-cut mud, and between 8,848-78 ft. recovery was 100 ft. of clean oil plus 540 ft. of oil and gas-cut mud.

Location is about 4 miles southwest of Crane and nearest deep oil is in the south end of Block 31 field, 5 miles to the northwest.

Gaines County . . . O. D. Alsabrook 1 T. S. Riley estate, Section 11, Block G, midway between the Russell and West Seminole shallow fields, had flowing oil on a drill-stem test between 9,161-9,223 ft. On the test, gas surfaced in 18 minutes and oil in 80 minutes, to flow at the estimated rate of 40 bbl. an hour. Flowing pressure was 1,453 psi.

Top of the Wolfcamp was 9,035 ft., minus 5,488 ft., which checked 147 ft. high to Shell Oil Co. 1 Foster, Devonian failure 2½ miles to the south in Section 408. The 1 Riley was projected to 12,000 ft. and operators were to drill ahead.

Upton County . . . Seaboard Oil Co. of Delaware 1 Julia Meiners, Section 19, 7 miles west of Spraberry production in North Pembrook area of the Spraberry Trend fields, developed oil and gas-cut mud on drill-stem test between 12,579-12,665 ft. Water blanket started flowing in 20 minutes. Recovery at the end of 2 hours was 570 ft. of oil and gas-cut water blanket, 630 ft. of oil-cut mud and 130 ft. of heavily gas-cut mud. The section tested was believed to be Devonian. Drilling continued below 12,679 ft.

Reagan County . . . On the west side of Big Lake field, Big Lake Oil Co. 1-11 University, 1 location west of San Andres production, developed 3,800 ft. of clean oil plus 300 ft. of oil-cut drilling mud on a drill-stem test of the Ellenburger between 8,920-61 ft.

The central area of Big Lake field also produces from the Ellenburger but operators believed 1-11 University had found a separate structure. Top of the Ellenburger was 8,905 ft. on ground elevation of 2,655 ft.

TEXAS GULF COAST

Indian Hills Extension Spurs New Development

Increased importance is being attached to the new Indian Hills field, in northern Harris County, by the completion of a good well by W. R. Godsey at his 1 Mahaffey, giving the field its third producer and an 1,800-ft. southwest extension.

With casing perforated at 5,535-39 ft. in the area's Cockfield pay sand, the new well flowed 140.62 bbl. of 38°-gravity oil on a 24-hour potential test through 9/64-in. choke, with 775-psi. pressure on the tubing.

Nearest well is the discovery producer completed last April by Federal Royalty Co. at 1 Schweinle. The field's second well, W. R. Godsey 1 Meyer, completed last September, extended production 1,200 ft. to the northeast.

Completion of the southwestern extension well has occasioned the starting of three additional tests. One of these is Godsey's second test on his 38-acre Mahaffey lease. Location is south of his initial well on the lease. The other two are by Federal Royalty Co., offsetting Godsey's extension well to the north, at 4 Schweinle, and to the east, at 1 Young.

Woodbine Production at Fort Trinidad Confirmed

Woodley Petroleum Co. and Moran Corp., joint operators, are confirming their recent discovery of Woodbine production in the Fort Trinidad field, on the Houston-Madison county line, with completion of their second well in the same formation.

Their confirmation well, 3 Bruton, flowed at the rate of 186.30 bbl. of 37.6°-gravity oil per day on potential gage through 12/64-in. choke. It had 400-psi. pressure on the tubing, and flowed with a gas-oil ratio of 615 cu. ft. per barrel.

As in the Woodbine discovery well, 2 Bruton, the pay horizon is the Dexter zone, in the lower part of the Woodbine section. It is producing from a casing-perforated interval of 8,654-88 ft. The discovery well is open at 8,690-8,712 ft.

Location of the second well is 1,530 ft. northeast of the discovery well. The above operators' next test in the area is to be 5 Bruton, located 2,400 ft. north of the discovery well.

LOUISIANA

NORTH LOUISIANA

"D" Sand Condensate Shows Found in Greenwood Field

O. G. Martin and associates have tested gas-condensate from what is believed to be the "D" sand of the Cotton Valley at 1 Willie Wilbert, 8-17n-15w, deep test in Caddo Parish's Greenwood field.

Recovery was 30 ft. of condensate and 12 stands, one joint of heavily condensate-cut water cushion on a 17-minute drill-stem test at 8,531-48 ft. Operator is drilling ahead at 8,559 ft. to look at the Bodcaw sand.

This is this part of the field's first Cotton Valley test. Nearest production in the field is 1 mile west at a Rodessa well which produces oil. Nearest Cotton Valley production is 4 miles to the northwest on the east side of Waskom field.

OKLAHOMA

Cleveland Strike to Go to Tulip Creek

Ashland Oil & Refining Co. 1 Nance, Cleveland County wildcat, will go to the Tulip Creek at 8,100 ft. The test, which is located in SW SE NW 19-17n-1e, is believed to be on the Nemaha granite ridge, and is 2½ miles southwest of North Helsel pool, a Bartlesville producer.

The wildcat is already established as a Wilcox discovery on drill-stem test at 6,971-78 ft. when 6,500 ft. of clean oil was recovered.

Rank Woods Strike Finaled in Arbuckle

Champlin Refining Co.'s rank Woods County discovery in northwestern Oklahoma is completed for 25½ bbl. of 43°-gravity oil in 24 hours by heads with 3.7 per cent salt water from perforations in the Arbuckle at 6,134-40 and 6,149-52 ft. Flow was natural. This rank strike also had indication Simpson and Viola production. Champlin is rigging up rotary tools at 1 O'Donnell, NE SE SW 17, one of two offsets planned.

Wildcat in McClain Drills Ahead After Bromide Show

K. A. Ellison et al are drilling ahead at 11,055 at their McClain Freeny area wildcat, the 1 Community Featherstone, C NW SE 35-8n-4w. The well flowed oil at the estimated rate of 35 bbl. per hour on a drill-stem test in the Bromide sand at 10,535-590 ft. The test had gas to the surface in 15 minutes at the estimated rate of 3,000 M.c.f. per day.

The test is located about 1½ miles southwest of Freeny pool, a two-well pool. North Freeny pool lies north of the indicated discovery in 14 and 13 and 23-8n-4w. Jay

Simmons is below 9,400 ft. at 2 Wilson in the C SW SE 14-8n-4w, moving field development to the northwest. Atlantic Refining Co. is drilling 1 City of Hartshorne in C NE SW 14-8n-4w. North Freeny pool has four producing wells.

KANSAS

Four New Strikes Reported in State

Operators have opened four new pools in various sections of Kansas recently. In Ellis County Sunray Oil Corp. has a new Arbuckle pool at 1 Schmeidler, NW NE NW 5-13s-17w. Pump potential is 178 bbl. of oil per day.

Carl Todd Drilling Co. 1 Pfenninger, C NE SW 8-20s-19w, Pawnee County, is a new pool discovery from the conglomerate with pump potential 83 bbl. of oil daily. In Reno County Pam-Kar Drilling Co. has finaled 1 Bacon, NE NW SW 36-23s-5w, as a Mississippi discovery for 178 bbl. of oil per day. In Sumner County, southern Kansas, Smitherman and Grove 1 McCorgary, SE SW SE 14-35s-2e, is a new Peru discovery with pump potential 100 bbl. of oil per day.

Testing Under Way at Hodgeman Discovery

I. W. Siegel et al have swabbed 5 bbl. of oil per hour from the Mississippian dolomite at 1 Smalley, SE SE NE 9-23s-24w. The wildcat is located 4 miles southwest of Jetmore pool, and 4½ miles north of Purdeyville pool in the central part of Hodgeman County.

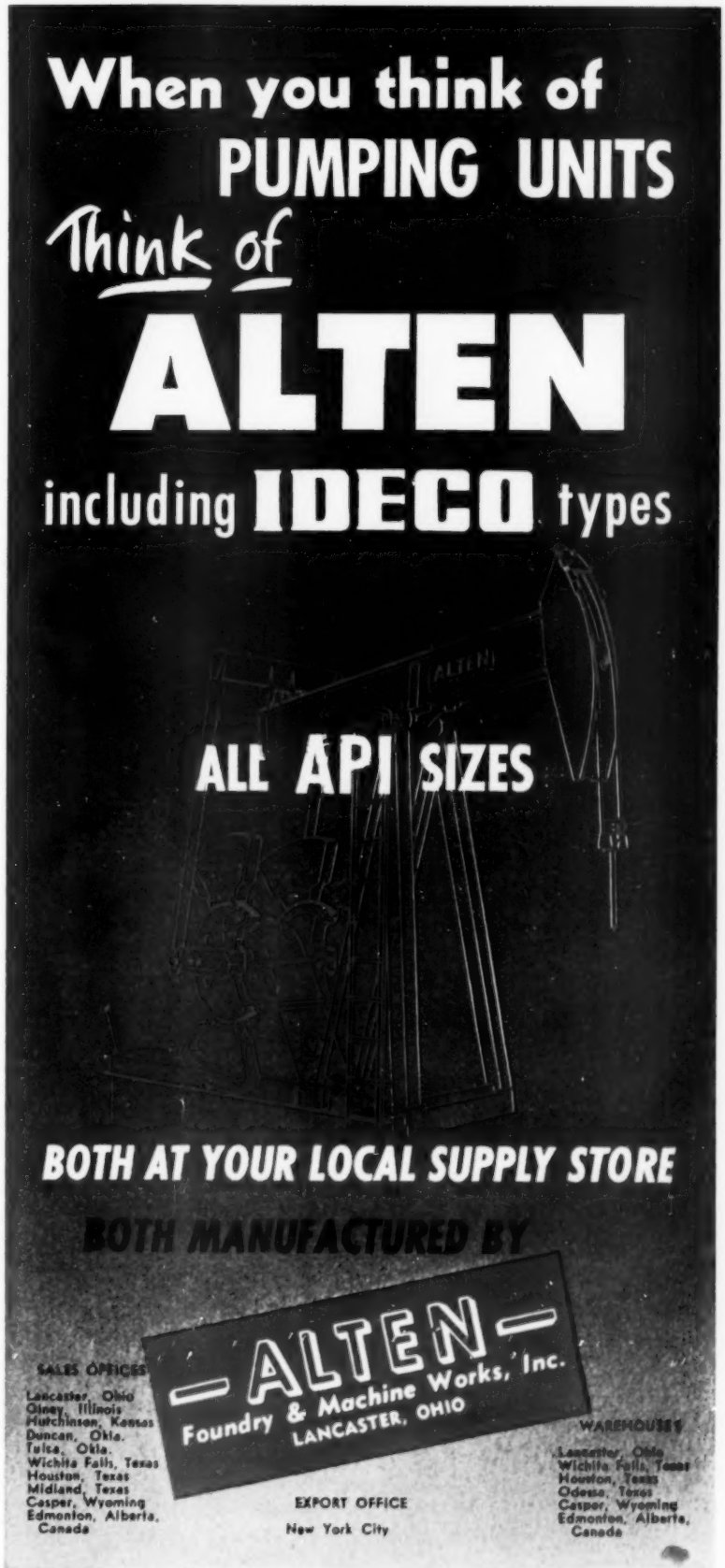
MICHIGAN

Porosity which showed some gas was logged at Carter Oil Co. 1 Lemcool, SE SW SW 9-25n-10w, Paradise Township deep test wildcat, Grand Traverse County.

Water-free porosity zones were logged at 7,186½-87 ft., 7,207-08 ft., 7,221-30 ft., and at 7,232½-33 ft. A drill-stem test was run at 7,233 ft. with packer set at 7,180 ft. Tool was open for 3 hours. Gas showed at the surface in 43 minutes with an estimated blow of from 5,000 to 10,000 cu. ft. Drill-pipe carried 590 ft. of gas cut drilling mud at the conclusion of the test. It is believed that this gas is showing from Clinton age rock in the basal Niagaran area. Although the gas was not commercial, wildcat was demed to be of some importance due to the presence of water-free porosity at this level, in or through the Niagaran. Well is expected to be bottomed out at about 7,266 and 7,270 ft. where hole will be surveyed and an additional drill-stem test of the entire Niagaran section will be run. Packer for this final test will probably be set at about 6,740 ft., just above the top of the Niagaran.

A good showing of Dundee gas appeared to have been logged in Lyons Township, Oakland County, at the William J. Morris 1 Davidson et al, C SE 36-1n-7e. Although no gages of gas showing at this wildcat were available, well was shut down and shut in this week with evidence of gas and pressure at the control head. Dundee top was logged at 722 ft. Gas showed at about 731-33 ft. Wildcat will be tested extensively at this depth.

Michigan's newest wildcat oil discovery



in Hume Township, Huron County, a new Detroit River "sour zone" oil producer, was rated good for 8 bbl. of oil and some water daily after acid treatment with 2,000 gal. Wildcat is being pumped. This well is the Alan S. Gray 1 Clancey, NE SW SW 12-18n-12e, which was drilled to 3,145 ft., total depth, but was plugged back to 3,120 ft. to test and acidize pay at about 3,111-18 ft. Additional drilling in this area is predicted.

INDIANA

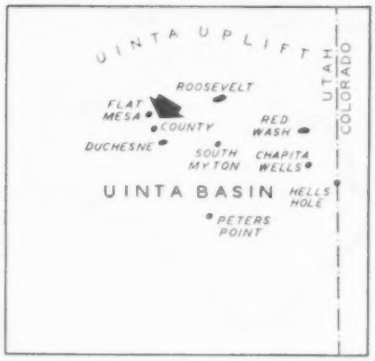
E. F. Moran-J. B. Buchman 1 Clyde Mackey, NE SW SE 31-7s-6w, 3 miles southwest of Rockport in Spencer County is an indicated new pool. The well has set casing at 1,171 ft. through saturated Tar Springs with total depth in the McClosky lime. It is 1 mile south of Rockport pool.

ROCKY MOUNTAIN

WYOMING

Ordovician Oil Recovered In Big Horn Basin

The first apparently commercial production from formations of Ordovician age in Wyoming is being tested by Argo Oil Co., Denver, at 51 Government, C SE SE 14-44n-98w, in Hamilton Dome field, Hot Springs County. The well was drilled to granite at total depth of 4,929 ft., and was plugged back to test Big Horn (Ordovician) at 3,542 ft. Recovery on swab was 500 bbl. of 13-15°-gravity oil in 24 hours. The operator is still testing. Previous production in Hamilton Dome field is from Embar, Tensleep and Madison. The field has produced more than 21 million barrels of oil since discovery in 1918.



Arrow points to Carter Oil Co.'s 1 Nielson, NE SE NW 36-3s-5w (USM), Duchesne County confirmation well to County pool. The well is a 1-mile south extension of the pool which was opened earlier in the year. Carter recovered 3,678 ft. of free oil and 150 ft. of mud-cut oil on drill-stem test at 4,520-4,600 ft. in the Green River. Oil recovered was 27° gravity, pour point being 55°. The discovery well of County pool is currently producing 200 bbl. of oil per day. The pool is of significance due to the fact that this is the first production from the Upper Green River in the Uinta basin. The pour point of the oil is below that produced in most Utah fields.

New Pool Opened At Neiber Dome

The California Co. is testing an apparent new pool opener 2½ miles east of previous production at Neiber Dome, Washakie County. The well, 5 Unit, NW SE SW 22-45n-92w, is believed located on a separate feature, distinct from the area in which two producers and two dry holes have previously been drilled in the unit. Flow on 21-hour test was 380 bbl. of oil. Production is from Phosphoria. The formation was topped at 10,088 ft. Casing was landed on top of the pay and production is in open hole to total depth of 10,118 ft. Gage is the best reported to date on this tructure.

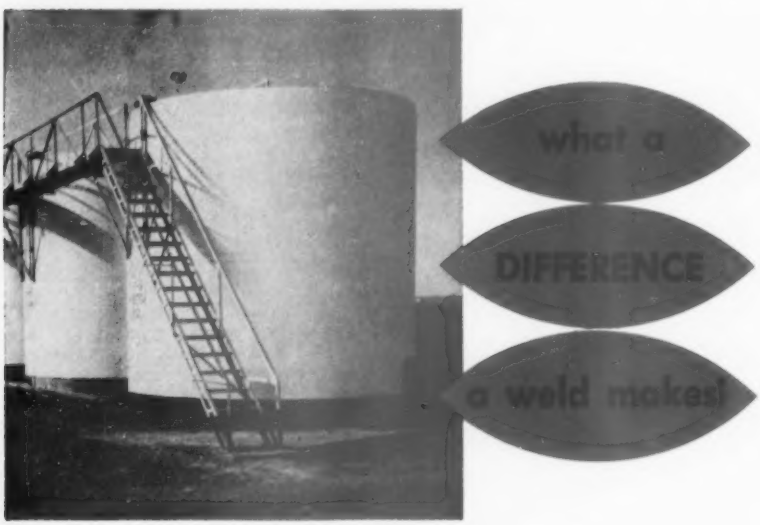
COLORADO

Deep Test Announced For Rangely Field

The Texas Co. has announced location for a projected Madison test in Rangely field, Rio Blanco County. Weber production in this field was established in 1934, but to date there has been no drilling below this Pennsylvanian reservoir. The field is the largest in the Rocky Mountain area with more than 20,000 acres proved productive in Pennsylvanian, and current production more than 65,000 bbl. per day. The deep test will be 70-32 UPRR, SW NE NW 32-2n-102w. Other operators in the field are not to participate in the deeper pool test, according to reports.

Carbonera Dome Gas Strike Indicated

Forest Oil Co. recovered gas with indications of commercial volume from Dakota sands at 1 Government, NE NW NE 2-7s-104w, Garfield County. Test of the interval 4,046-63 ft. made gas at the rate of 400,000



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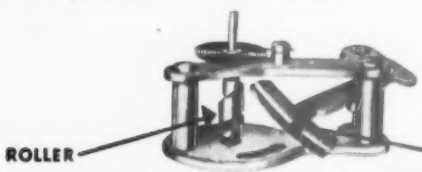

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cu. ft. per day after 8 minutes, and test was of 1¾ hours duration. Recovery in pipe was 113 ft. of gas-cut mud. Flowing pressure was 55-300 psi. Another test from 4,063-75 ft. made gas after 9 minutes with the volume estimated greater than that of the first test, but with no gage taken. At last report operator was pulling tool from this zone. The wildcat is scheduled as a 4,800-ft. test to Wingate, and is one of several being drilled as a result of currently stimulated interest in the west side of the state.

NEBRASKA

New Pay Found in Kimball County Pool

Eddie Fisher, independent operator of Brush recovered 2,064 ft. of high gravity oil on test of "J" sand at 1 Simler, NW NW NW 2-13n-56w. Test was of the interval 6,528-45 ft. There were no shows of consequence in the "D" sand in which production in this area was found in 1952. The recovery included in addition to the oil, 70 ft. of water and 50 ft. of mud. Tool was open 2 hours. Total depth of the discovery is 6,557 ft. with casing landed at 6,554 ft. Fisher has made location for a second well at 2 Simler, SE NW NW 2-13n-56w.

NORTH DAKOTA

Fryburg Confirmation Flows at High BOPH.

Amerada Petroleum Corp. has confirmed its Fryburg Billings County discovery with test of 1 Logan, C SE SW 4-139n-100w, ½ mile northwest of the Madison discovery in the area. The well flowed 225 bbl. of oil and 89 of water through 24/64-in. choke under tubing pressure of 100 psi. Production was from the open hole interval 9,434-51 ft. A second test flowed 206 bbl. of oil and 63 of water in 19 hours through the same choke. Amerada is continuing to test.

New Pay Reported At Tioga Pool

Amerada Petroleum Corp. reported a new pay discovery in the Mountrail County portion of Tioga field with recovery of oil from Devonian. The deep test in this pool is 3 Hanson, C SW NW 18-158n-94w, and test of the zone 9,913-10,020 ft. made 56 bbl. of 36°-gravity oil, 41 bbl. of water and 486 ft. of highly gas-cut and slightly oil-cut salt water. Flowing pressure was 1,700-3,700 psi. Top of Devonian was found at 9,440 ft. The well is the second test below Madison in the field. The first was 1 Bakken, 5¼ miles southwest of the current deep test. The new pay opener is drilling below 10,020 ft.

MONTANA

New Wildcats Dot State

New wildcat locations of considerable importance were made in several Montana areas during the past week. In the deeper eastern part of the state Lion Oil Co., made location for its first operation on the Montana side of the Williston basin at 1 Knight, C SW NW 29-14n-60e. It is to be a test to Cambrian at about 11,500 ft. west of the Cedar Creek anticline. Phillips Petroleum Co. and Amerada Petroleum Corp. will drill 1 NPRR, C NW NE 33-12n-53e in Prairie County. In central Montana The Chicago Corp. and Republic Natural Gas Co. made location for 1 Government, NE NE NE 18-11n-31e. McAlester

Fuel Co. will drill 1 Semingson, SW NE SE 13-1n-31e, 3 miles east of production in Northwest Sumatra field, Rosebud County.

In Chouteau County three new wildcats were staked. T. F. Hodge and associates had location for 1 Bartlett, NE NE 33-27n-7e, and for 1 Zell, SE NE 14-27n-7e. Milton Spencer, independent, will drill 1 Carpenter, NE NE SW 22-27n-7e. A considerable amount of attention has been focussed on this area for some time, although there has been no previous drilling large blocks of leases are known to be held in the area, however.

KENTUCKY

WESTERN KENTUCKY

Henderson County has a new producing area more than 1 mile from other production. T. M. Egan is developing the new area which is 3 miles northeast of Reed. One well has been finaled for 114 bbl. of oil per day from the Waltersburg sand at 1,191-1,205 ft. and two other wells are completing.

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CALIFORNIA

CALIFORNIA

Pyramid Hills Gas Discovery Indicated

Reserve Oil & Gas Co.'s wildcat ¾ mile south of Pyramid Hills field, Kings County, is expected to result in a new gas condensate discovery. Following a ½-hour formation test at 4,008-73 ft., during which gas flowed at an estimated rate of 3,300 M.c.f. daily, a substantial quantity of amber-colored condensate was recovered. A flowing pressure of 1,400 psi. was recorded on the test, which was in the second Kreyenhagen sand, Oligocene.

The wildcat, 48-20 Orchard in SE SW 20-24s-18e, blew out at 3,789 ft., causing a week-long fishing job. Following the formation test drilling was resumed and a depth of 4,863 ft. had been reached last week. It is anticipated hole will be carried sufficiently deep to see if the third Krenenhagen sand is oil productive before pipe will be set.

Humbolt Wildcat Being Tested

After reaching a depth of 8,246 ft. at its wildcat on the Alton anticline in coastal Humbolt County, B-N Development Corp. started extensive testing of shows encountered below 7,000 ft. First perforations were to be made at intervals between 7,890 and 8,125 ft. Four intervals between 7,050 and 7,300 ft. then will be tested, as well as four other sections further up the hole.

Designated 1 Rocha, and located in SE NW 16-2n-1w, the wildcat encountered heavy gas shows in the last few thousand feet. Principal shows were in the Rio Dell and Eel River zones of middle and upper Pliocene. The latter is the gas pay at The Texas Co.'s nearby Tompkins Hill field. It is believed the B-N wildcat possibly may be bottomed in the Pullen zone of upper Miocene age.

North Arvin Given Chanac Pool

The Texas Co. 1 Arvin Unit, which last July was completed as an extension to set off a new drilling flurry in the North Arvin area of Kern County, has been recompleted as the discovery in a new Chanac pool. Originally completed through perforations at 6,960-7,039 ft. in the Santa Margarita, the well now is producing 40°-gravity crude from perforated intervals between 5,835-6,430 ft. Initial production of 1 Arvin Unit was 120 bbl. daily through a 9/64-in. choke. It is located in NW NE 26-31s-29e, near where six other wells were drilling or in process of completion.

New Merced Wildcat

Merced County, which in recent months has been subjected to an intensive exploratory search, shortly will receive another wildcat. Richfield Oil Corp. has staked location for 1 Henderson in NW 34-6s-13e, or approximately 5 miles northwest of the town of Merced. The company's recent 4,100-ft.

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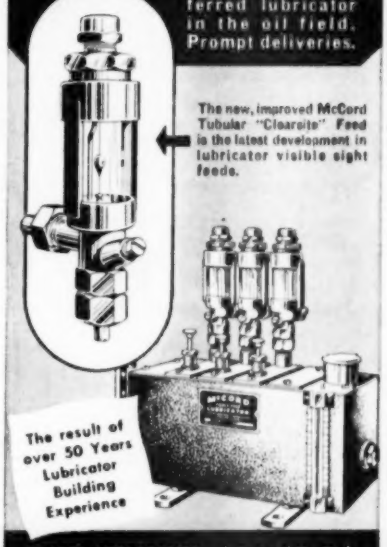

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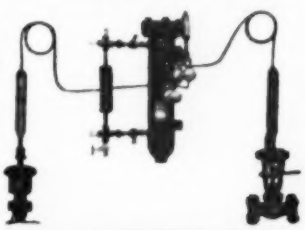

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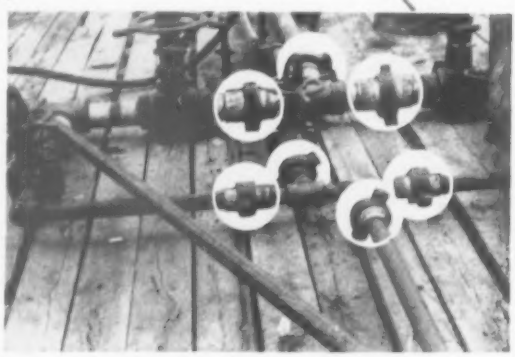

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dry hole, 54-34 Fancher, was drilled 3 miles southeast of the town. Shell Oil Co., which has extensive holdings south of the Richfield block, continued a core-drilling program.

Guadalupe Test Being Pumped

General Petroleum Corp. was preparing to set pumping equipment at its wildcat 3 miles south of Guadalupe field in San Luis Obispo County. A 7-in. string had been set at 4,501 ft., total depth, and cemented through perforations at 4,098 ft. Location of the test, 1 Mahoney, is in NW SW 9-10n-35w.

ARKANSAS

Hill Discovery Seen In Miller County

Sinclair Oil & Gas Co. has a possible Hill gas-condensate discovery in southeastern Miller County.

The operator is coring below 5,973 ft. after testing shows of gas and condensate in the Hill zone of the Rodessa at 1 John R. Nelson, SW NE 7-20s-26w. Recovery on the test was 470 ft. of condensate and gas cut with mud and 100 ft. of salt water cut with condensate and gas. The test was made at 5,935-73 ft.

Nearest Rodessa production is on the east side of Rodessa field 4 miles southwest.

APPALACHIAN AREA

PENNSYLVANIA

In Pine Township, Indiana County, Southwest Pennsylvania, Chas. Fralich, has made a location for a wildcat test 1 Charles Liesowity, Barnesboro Quadrangle, 5.58 miles south of latitude 40 degrees 40 minutes and 2.25 miles west of longitude 78 degrees 55 minutes.

In Clay district, Wirt County, West Virginia, United Fuel Gas Co. is moving in a rotary outfit to continue deeper drilling at 6812 Cora L. Brown, elevation 1,063 ft., Elizabeth Quadrangle, 5.6 miles south of latitude 39 degrees 10 minutes and 3.6 miles west of longitude 81 degrees 15 minutes. The formations reached in this well were Big lime, 1,040-1,140 ft., Berea sand 1,659-1,672, Corniferous lime 4,848-5,030 ft., Oriskany sand 5,020-5,164 ft. The present depth at which the well is shut down is 5,180 ft. Glade district, Webster County, Gregory Gas Co. 1 C. D. Howard heirs, encountered additional gas in the Maxon sand at 1,460 ft., increasing the initial open flow volume of 730,000 cu. ft., to 2,900,000 cu. ft.

OHIO

Great Lakes Carbon Corp. found the Oriskany sand dry in a second unsuccessful test in the area east of Harriettsville in Noble County. On 1-O Herman Pabst, Section 15, Elk Township, the sand was logged at 5,001-5,039 ft. with no shows, and casing will be pulled to test the Ohio shale.

In the northeast part of Hanover Township, Licking County, Wray Drilling Co. completed the 4 Frank Westbrook, Lot 10, as a nice producer. Clinton at 2,877-2,903 ft. filled 1,000 ft. in 14 hours and made 350 bbl. in 24 hours after fracturing.

In Walhonding pool in New Castle Township, Coshocton County, Preston Oil Co. 1 W. F. Heffelfinger, Lot 12, logged the Clin-

ton at 3,233-3,293 ft. with a good show of oil that increased to 119 bbl. in 24 hours after fracturing.

CANADA

Alberta Reports Two New Discoveries for Week

There were two wildcat strikes in western Canada this week, both in Alberta. One of the new finds flowed crude oil and the other gave up natural gas. The oil discovery was chalked up in the Scope area of southeast Alberta, about midway between Lethbridge and Medicine Hat, while the gasser is in the Dyberg area of central Alberta, 50 miles south of Edmonton.

Northern Development Co., Ltd., and Union Oil Co. of California reported a crude oil flow at the exploratory venture that Northern is drilling on Union farmout lands near Scope railpoint and 40 miles south of Brooks. The well, Northern Development-Union 13-11 Crown, LSD 13, 11-12-14w4, drill-stem tested from 3,033½ to 3,051 ft. for 1 hour. Oil, probably of medium gravity quality, flowed to the surface in 47 minutes, and pipe recovery was 1,520 ft. of oil and 1,050 ft. of slightly salty water. Scheduled as a Madison test, the 13-11 well was taken to that formation, to 3,107 ft., but found the limestone water-loaded. Log is now being run.

On the basis of available information, indications are that only a thin oil productive section is present at the Scope discovery, and as yet decision on running of production casing has not been made. The productive formation is believed to be either of Cretaceous or Jurassic age.

Samson Indian Reserve . . . The gas strike this week came at the joint venture a few miles east of the Samson Indian Reserve, that is being drilled by Texaco Exploration Co. and The California Standard Co. This well, Texaco-Cal Standard 1 Dyberg, LSD 8, 15-44-23w, is 12 miles southeast of Wetaskiwin, 7½ miles east-northeast of the Western Leaseholds-Union team's Samson basal Cretaceous oil discovery and about that same distance northwest of the Seaboard-Gulf group's Devonian oil discovery well at Samson Lake.

The 1 Dyberg found its gas in the Belly River formation during drill-stem test of interval 2,154 to 2,248 ft. Gas flowed in 15 seconds, at maximum rate in excess of 2½ million cu ft. daily. Hole is now deepening, and will be taken down as a test of all formations to and including the Cooking Lake, to a projected depth of 6,300 ft.

Hamilton Lake . . . Calvan Consolidated Oil & Gas Co., Ltd., and associates have found some oil in the Viking sand at their extension

(Continued on page 205)

WILDCAT COMPLETIONS

SOUTHWEST TEXAS

Bexar County: Karl Arnold 2 Dillon, Manuel de Luna Sur., A-8. Dry. TD 3,000 ft.

Caldwell County: H. R. Smith 1 Biggs, Gerren Hinds Sur. Dry. TD 4,470 ft.

Dimmit County: Fred W. Shield 1 Marrs McLean estate, Block 23, Narciso Aguire Sur. 177. Dry. TD 5,225 ft.

Duval County: J. W. Gorman 1 Rogers Share 40, Jose Marcelo Hinojosa Grant. Dry. TD 4,315 ft.

The Texas Co. 1-A DCRC NCT-6, AB & M Sur. 47, A-686. Dry. TD 2,510 ft.

The Texas Co. 1-A DCRC NCT 11, S½ S½ Adolph Perez Sur. 270, A-1775. Dry. TD 3,012 ft.

Frio County: Drilling Exploration, Inc., 1 M. B. Sadler estate, W. A. Sadler Sur. 90/7, A-1414. Dry. TD 3,228 ft.

Howeth & Mason 1 Berry, BS & F Sur. 1, A-691. Dry. TD 3,649 ft.

Howeth & Mason 1 Labatt, John B. Uphus Sur. 169, A-646. Dry. TD 3,597 ft.

Hidalgo County: Barron Kidd 1 Fisher & Ryder, Lot 124, La Lomita Irrigation Co. Subd. Dry. TD 8,013 ft.

Stanolind Oil & Gas Co. 1 Phoenic, La Blanca Grant. Dry. TD 12,683 ft.

Taylor Oil & Gas Co. 1 Alexander, Sur. 30. Dry. TD 12,754 ft.

Jim Wells County: Delhi Oil Corp. 1 Bishop, Los Presenos de Abajo Grant, A-171. Dry. TD 9,015 ft.

W. Earle Rowe 3-B Embleton, Welhausen & Driscoll Subd., La Tinaja de Lara Grant, A-36. Dry. TD 5,423 ft.

Medina County: A. T. Jergins & Sons, Ltd., 1 Wilson, William Scott Sur., Sec. 509. Dry. TD 1,789 ft.

Milam County: Murvale L. Richards 1 Batte el al, Daniel Monroe Sur. Dry. TD 1,160 ft.

Nueces County: George E. Farenthold 1-A Knolle, O. B. Carver Subd., Bitterman Tract, Casa Blanca Grant. Dry. TD 6,451 ft.

Pratt Hewit Oil Corp. et al 1 Albert, Sec. 2, George H. Paul Subd., Driscoll Ranch. Dry. TD 8,018 ft.

San Patricio County: Lee Brothers Oil Co. and Kirkwood & Morgan 2 Burnell Miller, E. J. McGloin Sur., A-24. Dry. TD 4,458 ft.

Pan American Production Co. 2 Brown, Tract 3, MEP J & N Delago Grant. Dry. TD 5,500 ft.

Starr County: Appell Oil & Gas Corp. 1 R. E. Margo estate, Share 3-B, Porcion 70. Flowed dry gas, no gage, shut-in. TD 5,312 ft.

Standard Oil Co. of Texas 1 Manuel Guerra, Jr. Francisco Garcia Sur., A-330. Dry. TD 5,005 ft.

Wilson County: Wymore Oil Co. 1 Donaho, J. Jordan Sur. 371. Dry. TD 3,004 ft.

Zapata County: Bridwell Oil Co. 3 Rosa Rodriguez, Share E, Charco Redondo Grant. Dry. TD 1,847 ft.

TEXAS GULF COAST

Bee County: Pontiac Refining Corp. 2 Scott, Jose Maria Uranga Grant. Dry. TD 3,400 ft.

Sparton Drilling Co. 1 Wolters, Peter Allen Sur., A-77. Dry. TD 6,502 ft.

Brazoria County: Columbia Drilling Co. 1 Poole et al, Thomas & William Alley Lge. 64, A-2 (Allen Dome). Dry. TD 730 ft.

Continental Oil Co. 2 Perry, Sterling McNeil Sur., A-94 (Allen Dome). Dry. TD 13,385 ft.

H. B. Hebert and C. W. Vick 1 French et al, Lot 12, Bogart & Taylor Subd. of west half of W. D. C Hall Sur., A-69 (Bonney area).

Chambers County: Humble Oil & Refining Co. 1 Round Point Gas Unit, Anson Taylor Sur., A-241. Dry. TD 8,800 ft.

Fort Bend County: Houston Oil Co. of Texas 1 Way et al, I&GN Sur. 1, A-365. Dry. TD 8,103 ft.

Goliad County: Morris Cannan and Wynn D. Miller 1 N. A. Kilgore est., J. Carpenter Sur., A-96. Dry. TD 5,625 ft.

Jackson County: Alex W. Head and John L. Welsh, Jr., 1 T. N. Mauritz est. et al. Dry. TD 6,820 ft.

W. Earle Rowe and Great Lakes Carbon Corp. 1 Cox, Carlos Lasso Sur., A-40. IP 19,000 M.c.f. daily, open flow, casing perforations 6,246-54 ft. TD 6,444 ft. (New field.)

Southern Minerals Corp. 1 Bagby-Germer, Thomas H. P. Heard Sur., A-30. Dry. TD 5,513 ft.

Lavaca County: Texas Eastern Production Corp. 1 Simpson heirs, Amando de la Crox Sur., A-112. Dry. TD 9,203 ft.

Live Oak County: J. C. Petkas 1 Gayle, Section 61, Simmons Subd. Dry. TD 7,868 ft.

Matagorda County: Shell Oil Co. 1 Kain et al, James Duncan Lge. & Labor, A-144. IP 6,155 M.c.f. daily and 12.3 BCPD, 20/64-in., 43°, casing perforations 6,015-25 ft. TD 7,060 ft. (New field on Matagorda Peninsula.)

Wharton County: John B. Coffee 6-C Kountz & Stewart, Morris & Cummings Sur., A-283. IP 114 BOPD, 7/64-in., 41.4°, casing perforations 5,718½-22½ ft. TD 6,977 ft. (New pay in East Mauritz field.)

The Texas Co. 1 Heavaty, Lyman Conkrite Sur., A-16. Dry. TD 5,624 ft.

EAST TEXAS

Cherokee County: Miller & Walker 1 Lemaster, Josiah Culp Sur., A-167. Dry. TD 4,473 ft.

Franklin County: Humble Oil & Refining Co. 1 Ballard, J. L. Elder Sur., A-155. IPP 124 BOPD, 43°, Rodessa perforations 8,232-50 ft. TD 8,531 ft.

Kaufman County: T. D. Humphrey and American Liberty Oil Co. 1 Kaufman County Farm, D. Falcon Sur., A-151. Dry. TD 5,705 ft.

WEST CENTRAL TEXAS

Coleman County: Miller & Banks 1 M. A. Coffee, W. H. King Sur. Dry. TD 2,408 ft.

H. M. Naylor 1 Stone, Sec. 73, H. M. Childress Sur. Dry. TD 5,347 ft.

Haynes B. Ownby Drilling Co. 1 Galloway, Sec. 41, BBB&C. Dry. TD 3,671 ft.

Fisher County: P. G. Lake, Inc. 1 Annie Hilburn, 179-3-H&TC. Dry. TD 6,949 ft.

Haskell County: Bridwell Oil Co. 1 Hendrick estate, Sec. 103, Indianola RR Sur. IP 348 BOPD, 36-in., 39°, pay 5,190-5,222 ft. TD 5,400 ft.

Jones County: Sid Katz Exploration Co. 1 Baker, Sec. 36, OAL Sur. Dry. TD 2,606 ft.

Miami Operating Co. 1 McDonald, Blk. 74, DeWitt CSL Sur. 125. Dry. TD 4,998 ft.

Robinson-Puckett and American Liberty 1 Pittman, 42-1-BBB&C. Dry. TD 2,845 ft.

Sojourner Drilling Co. 1 Bartlett, Sec. 206, A. Wagner Sur. IPP 124 BOPD, 35°, pay 2,540 ft. TD 3,205 ft.

Travis Drillers, Inc. 1 Stevens, E. Daggett Sur. 216. Dry. TD 3,406 ft.

Nolan County: Union Oil Co. of California 1 Starnes, 74-22-T&P. Dry. TD 6,580 ft., elev. 2,190 ft., Ellenburger 6,510 ft.

General Crude Oil Co. 1 Nolan Townsite, 310-64-H&TC. Dry. TD 6,402 ft., elev. 2,490 ft., Ellenburger 6,330 ft.

Nolan County: Phillips Petroleum Co. 3 Beckham, Clark Sur. 287. Dry. TD 5,760 ft.

Palo Pinto County: Pete Hall Drilling Co. 1 McQueary, Sec. 39, T&P. Dry. TD 1,574 ft.

Parker County: T. Jack Foster 1 Herring, A. B. Blackburn Sur., A-163. Dry. TD 4,510 ft.

Shackelford County: G. B. Cree 2 Davis, 8-13-T&P. Dry. TD 1,630 ft.

Edgar Davis Drilling Co. 2 Windham, 81-

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FOR OIL INDUSTRY CHEMICAL SERVICE

WILDCAT COMPLETIONS

13-T&P. IP 167 BOPD, ¼-in., 39°, pay 3,884 ft. TD 3,891 ft.

Stonewall County: H. L. Hunt 1 Beulah Branch, 341-2-H&TC. Dry. TD 6,574 ft., elev. 1,970 ft., Mississippian 6,556 ft.

Taylor County: C. M. Ashby 1 Herman Sour, 131-64-H&TC. Dry. TD 5,465 ft.

Roark-Hooker & Roark 1 Mrs. Ida Hammer, 23-19-T&P. IP 189 BOPD, 16/64-in., 40°, reef pay 4,660-65 ft. TD 5,488 ft.

Throckmorton County: E. R. Perkins 1 Mary G. Chandler, Sec. 3036, TE&L Sur., A-629. Dry. TD 3,810 ft.

Cox Drilling Co. 1 Norton Properties, Blk. 2216, TE&L Sur. Dry. TD 4,795 ft.

NORTH TEXAS

Archer County: M. W. Blair 1 Harmel, Blk. 24, League 4, Denton CSL. Dry. TD 1,803 ft.

M. W. Blair 2 Richardson "D," TE&L Sur. 2425. Dry. TD 1,455 ft.

R. C. Tittle 1 Turbeville, Blk. 44, Jefferson CSL. Dry. TD 1,936 ft.

Clay County: Elmer Brashear 1 John Barry, Blk. 2642, TE&L. Dry. TD 887 ft.

Grayson County: Kay Kimbell 1 J. C. Bailey, Martin K. Snell Sur., A-1132. IP 120 BOPD, 3/16-in., 31°, pay 5,331-42 ft. TD 5,342 ft.

Jack County: G. E. Kadane & Sons 1 Marks, B. C. Thompson Sur., A-616. IP 128 BOPD, 14/64-in., 44°, pay 5,089 ft. TD 5,282 ft.

W. H. Peckham 1 Biggers, J. R. Wallace Sur., A-1496. Dry. TD 3,204 ft.

Montague County: Hefner Production Co. 1 Hawkins, G.W. Parks Sur., A-591. Dry. TD 2,010 ft.

Young County: Leland Fikes 1 Scruggs, Blk. 1942, TE&L Sur. Dry. TD 4,515 ft.

J. Earle Gray 1 Roenfeldt, Blk. 239, TE&L Sur., A-486. Dry. TD 1,123 ft.

Trans-Continental Oil Corp. 1 Graham Estate, G. W. Robinson Sur., A-1820. Dry. TD 4,748 ft.

Trans-Continental 1 Mrs. Eliz C. Kelly, J. A. Kiser Sur., A-1736. Dry. TD 4,679 ft.

WEST TEXAS

Andrews County: Humble Oil & Refining Co. 1-T State University, 25-1-University Lands. IP 404 BOPD, ½-in., 40°, Wolfcamp top 8,230 ft., pay 9,050-80 ft., elev. 3,138 ft. TD 9,183 ft.

Coke County: Deep Rock Oil Co. 1-A White, 286-1A-H&TC. Dry. TD 6,645 ft.

Crosby County: H. L. Hunt 1 Morgan Jones, 5-3-WCRR. Dry. TD 8,316 ft., elev. 2,981 ft., Pennsylvanian 8,100 ft.

Hockley County: Stanolind Oil & Gas Co. 1 Armes, 54-P-C&MRR. Dry. TD 11,494 ft., elev. 3,377 ft., Ellenburger 11,365 ft., pre-Cambrian 11,486 ft.

Irion County: Hill & Meeker 2 Sugg, 22-1-H&TC. Dry. TD 950 ft.

King County: Shell Oil Co. 1-D S. B. Burnett Estate, 15-X-R. M. Thomson Sur. Dry. TD 6,400 ft., elev. 1,805 ft., Strawn 5,385 ft., Mississippian 5,915 ft., Ellenburger 6,260 ft.

Loving County: Jess Lynch 1 Johnson, 12-57-T1-T&P. Dry. TD 3,173 ft.

Midland County: Plymouth Oil Co. 1-38 Midkiff, 38-39-T4S-T&P. Dry. TD 13,466 ft., elev. 2,795 ft., Devonian 12,228 ft., Simpson 13,050 ft., Ellenburger 13,324 ft.

Pecos County: G. D. Putman & Co. 1-A Price, 7-12-H&GN. Dry. TD 3,125 ft.

Runnels County: Geochemical Surveys 2 Kurtz, T. R. Webb Sur. 357. Dry. TD 4,050 ft.

Union Sulphur & Oil Corp. 2-B Bright, CCSD&RGNG Sur. 36. Dry. TD 4,150 ft.

Schleicher County: Ralph Lowe 1 O'Harrow, 60-H-GH&SA. Dry. TD 5,430 ft., elev. 2,353 ft., Strawn 5,305 ft.

Lucerne Corp. 1 E. O. Williams, 13-1-GH&SA. Dry. TD 4,150 ft., elev. 2,275 ft., Canyon 4,106 ft.

Scurry County: The Texas Co. 2 M. A. Fuller, 606-97-H&TC. Dry. TD 8,120 ft., elev. 2,415 ft., Mississippian 7,807 ft.

Terry County: J. M. Ferguson 1 Osborne, 14-D14-C&M. Dry. TD 7,005 ft.

Winkler County: Ralph Lowe 1-B Tobe Morton, 19-B12-PSL. Dry. TD 3,510 ft.

SOUTHEAST NEW MEXICO

Eddy County: J. E. Metcalf & R. R. Wooley 1 State, 2-21s-27e. Dry. TD 768 ft.

Lea County: Western Natural Gas Co. 1 Millard Eidson, 35-16s-35e. IP 840 BOPD, ½-in., 60°, Devonian perforations, 12-482-12,600, 12,632-12,680 ft., elev. 3,977 ft. TD 12,757 ft.

NORTHERN NEW MEXICO

San Juan County: Southern Union Gas 2-A Texas-Navajo, NW SE NW 25-32n-18w. Dry. TD 8,168 ft. Paradox 7,155 ft.

ILLINOIS

Edgar County: E. Zink 1-A Honnold, SW NE NW 1-13n-14w. Dry. TD 270 ft.

Wm. A. Fullenkamp 1 McDavitt, NW SE SE 29-13n-13w. Dry. TD 698 ft.

Gallatin County: John W. Rudy 1 Oldham, SW SW SE 19-8s-8e. Dry. TD 3,053 ft.

Coy Oil Co. 1 Edwards Comm., SW NW SE 3-8s-8e. Dry. TD 2,959 ft.

Coy Oil Co. 1 Flanders, NW SE SW 2-8s-8e. Dry. TD 2,960 ft.

Logan County: H. C. Herring 1 Bryson-Higgins Comm., W½ SE NW 36-18n-3w. Dry. TD 1,650 ft.

Macoupin County: H. E. Livermore 1 Darris, SE SE SW 26-7n-7w. Dry. TD 600 ft.

Perry County: Lewis & Pickens 1 Ibendahl, NE SE NE 4-4s-3w. Dry. TD 1,363 ft.

Washington County: Inland Oil Co. 1 Bartaszek, SE SE SW 26-2s-2w. Dry. TD 1,521 ft.

INDIANA

Dubois County: Pure Oil Co. 1-A Seidl, SW NE NW 35-3s-5w. Dry. TD 2,597 ft.

Gibson County: Whaley Oil Co. 1 Wilhite & McConnell, NE SE NE 11-2s-10w. Dry. TD 1,623 ft.

Posey County: Calvert Drilling Co. 1 Eli Schroeder, SE NW SE 8-6s-12w. Dry. TD 2,850 ft.

Spencer County: Walter Sargent 1 Egnew, SE SW NW 33-5s5w. Dry. TD 1,279 ft.

Cox Drilling Co. 1 Crafton, SE NE NE 12-6s-6w. Dry. TD 1,419 ft.

Sullivan County: Sun Oil Co. 1 Sherwood-Templeton Coal Co., SW SW NW 9-8n-8w. Dry. TD 2,159 ft.

Vigo County: Pure Oil Co. 1 Acord, SE NW NW 13-13n-10w. Dry. TD 1,857 ft.

TENNESSEE

Fentress County, Wolf River: Guy Williams 1 Pyle, SE NW NW 12-A-55e. Oil. TD 1,134 ft.

Robertson County, Barren Plains: Jackson et al 4 Clinard, SE SE SE 19-E-31e. Dry. TD 1,462 ft.

KENTUCKY

Daviess County: Shelby McIntosh 1 Johnson, SE SW NE 13-O-31. Dry. TD 1,500 ft.

Hopkins County: Atkins & Hale 2 Brown, SW SW SW 6-J-22. Dry. TD 2,055 ft.

Logan County: P. McGinley 2 Miller, NW NE NE 12-F-33. Dry. TD 1,575 ft.

McLean County: John Ross 1 Montgomery, SE SW NW 18-M-29. Dry. TD 1,640 ft.

Muhlenberg County: J. H. Deimerly 1 (2) Talbert, NW SW SW 21-H-30. Dry. TD 920 ft.

Ohio County: J. R. Fisher 1 Bishop, NE SW SW 21-L-33. Dry. TD 1,403 ft.

MICHIGAN

Allegan County: Ford Oil Co. 1 Hazen, NW SW NE 14-3n-12w. Dry. TD 1,746 ft. in Traverse lime.

Clinton County: McClure Oil Co. and Tom Mask 1 Pohl, NE SE NW 15-7n-4w. Dry. TD 2,592 ft. in Traverse lime.

Crawford County: Dow Chemical Co. 1 Johnston et ux, NW NW SW 16-28n-3w. Dry. TD 4,002 ft. in Richfield.

Hillsdale County: Grand Valley Drilling Co. 1 Bennet, NW SE SW 9-5s-4w. Dry. TD 1,409 ft. in Traverse lime.

Huron County: Alan S. Gray 1, Clancy, NE SW SW 12-18n-12e, IPP 8 bbl. daily, plus water after 2,000 gal. acid. Pay 3,111-15 ft. in Detroit River, TD 3,145 ft. PBTD 3,120 ft.

Oceana County: Associated Drillers & Producers, Inc. 1 Williams et ux, SE SE SE 27-16n-15w. Dry. TD 2,720 ft. in Dundee.

Van Buren County: Harris Oil Co. Tyszka, SW NE NW 28-3s-13w. Dry. TD 1,172 ft. in Traverse lime.

P. K. Degenther 1 Ewing, SW NW SE 16-4s-13w. Dry. TD 1,210 ft. in Traverse lime.

Cook Drilling Co. 1 Turner, NE NW NW 30-4s-13w. Dry. TD 1,150 ft. in Traverse lime.

ALABAMA

Clarke County: I. P. and Fred La Rue 1 Scotch, C SW SW 34-12n-1e. Dry. TD 3,690 ft. Elev. 99 ft., Eutaw 2,311 ft., marine Tuscaloosa 3,520 ft., Pilot sand 3,486 ft.

MISSISSIPPI

Adams County: B. Serio and G. W. Gulmon 1-G Armstrong, 7-4n-2w. Dry. TD 7,209 ft. Elev. 76 ft., Vicksburg 2,571 ft., Cook Mountain 3,384 ft., Wilcox 4,772 ft., base Baker shale 6,501 ft.

Copiah County: Marshall R. Young 1 Ricketts, 10-9n-7e. Dry. TD 10,302 ft. Elev. 344 ft., Wilcox 3,630 ft., Chalk 7,915 ft., marine Tuscaloosa 9,779 ft., lower Tuscaloosa 10,020 ft., Massive 10,122 ft., lower Cretaceous 10,180 ft.

Jasper County: Clements-Stanford & Clinch Drilling Co. 1 Green, SE SE SE 13-2n-11e. Dry. TD 6,115 ft. Elev. 327 ft., Wilcox 1,112 ft., Chalk 3,854 ft., Eagle Ford 5,084 ft., Tuscaloosa 5,527 ft.

Wayne County: Lyle Cashion Co. et al 1-A Board of Supervisors, SW SW SE 16-10n-7w. Dry. TD 5,010 ft. Elev. 219 ft., Selma 3,436 ft., City Bank (Eutaw) 4,647 ft., Sanley sand (Eutaw) 4,712 ft.

SOUTH LOUISIANA

Cameron Parish: British - American Oil Producing Co. 1 Henry, 27-14s-9w. Dry. TD 11,275 ft.

Plaquemines Parish: Humble Oil & Refining Co. 2 State Lease 2026, Township 19s-28e. Dry. TD 11,502 ft.

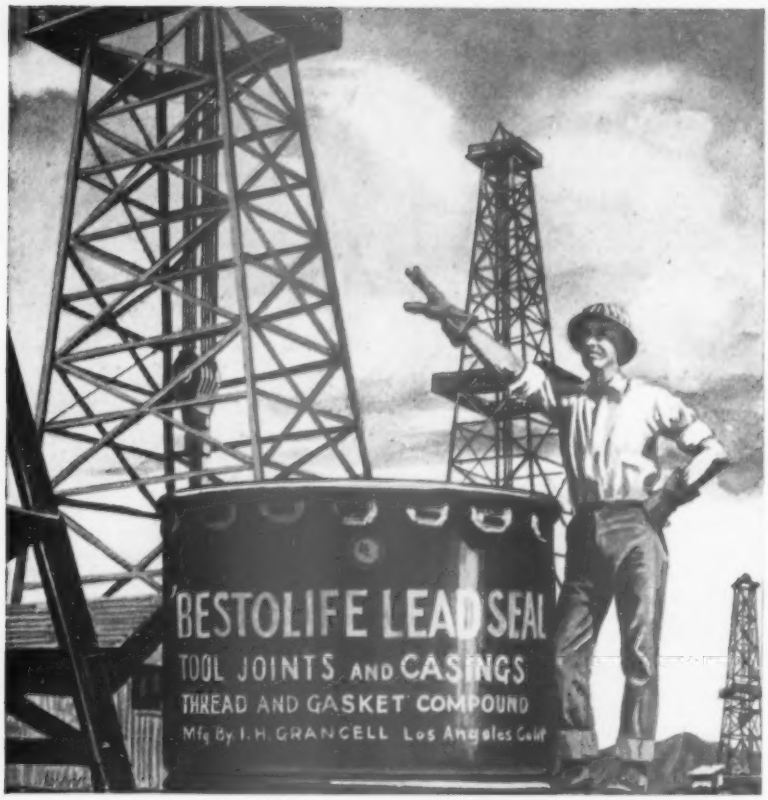
St. Charles Parish: Pan American Production Co. 3 Simoneaux, 20-14s-21e. IP 83 BCPD and 2,132 M.c.f. daily, 20/64-in., 55.7°, casing perforations 10,210-20 ft. TD 11,194 ft. (New pay in Boutte field).

NORTH LOUISIANA

Bossier Parish: Spartan Drilling Co. 2 Martin, near NEc SE SW 24-20n-14w. Dry. TD 974 ft.

Concordia Parish: Jett Drilling Co. et al 1 Kervin - Johnson, 6-6n-9e. Dry. TD 7,005 ft.

Hunt Oil Co. and Gulf Refining Co. 7



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WILDCAT COMPLETIONS

Angelina Hardwood Co. "C," C SW SW 20-5n-8e. IPF 140 BOPD, Wilcox 6,478-82 ft., 42°, 12/64-in. TD 7,102 ft. (Discovery tentatively named North Cocodrie Bayou.)

Hunt-Gulf 11 Angelina Hardwood Co. "C," C NE SW 20-5n-8e. Dry. TD 6,740 ft.

Grant Parish: Justiss-Mears Oil Co. 2 International Paper Co., C S½ NW SE 20-8n-4w. Dry. TD 4,042 ft.

LaSalle Parish: Hunt-Gulf 89 Louisiana Delta Lumber Co., C NE SW 1-5n-3e. Dry. TD 5,213 ft.

Morehouse Parish: Carter Oil Co. 1 Hope Fee "C," C NW NE 30-22n-9e. Dry. TD 7,491 ft. Igneous 7,143 ft.

Webster Parish: Atlantic Refining Co. 1 Alexander, near SWc 17-18n-8w. Dry. TD 4,106 ft.

ARKANSAS

Miller County: Smead Stuart et al 1 Anthony-Reed, C NW SW NW 12-14s-27w. Dry. TD 4,205 ft.

OKLAHOMA

Cimarron County: Columbian Fuel 1 Taylor, C NW SW 23-6n-9eCM. IP 22 BOPD, 4,645-55 ft. TD 4,908 ft. (Oil well.)

Love County: Sinclair Oil & Gas Co. 1 Baker, SE SE NW 35-8s-2e. Dry. TD 5,542 ft.

Noble County: B. B. Blair 1 Treeman, NW NW NE 24-23n-2e. Dry. TD 4,396 ft.

Clay & Son, Inc. 1 Clay-Lewis, NW NW SW 32-20n-1w. Dry. TD 1,875 ft.

Pontotoc County: Wm. H. Pine 1 Davisson, SE NW NE 1-2n-4e. Dry. TD 2,285 ft.

Pottawatomie County: Delaney 1 Davis, NE NE SW 13-11n-2e. Dry. TD 5,885 ft.

KANSAS

Ford County: Continental Oil Co. 1 Lane estate, NE NE NW 28-29s-21w. Dry. TD 6,203 ft.

Gove County: Wycoff 1 Dair, NW NW NW 35-12s-30w. Dry. TD 4,484 ft.

Gray County: Coppinger-Buffalo Oil 1 Lasater, C SE NW 33-29s-27w. Dry. TD 5,454 ft. St. Louis 5,256 ft.

Kingman County: Beardmore 1 Voran, SE SE SE 11-29s-7w. Dry. TD 4,720 ft.

Logan County: Wycoff 1 Gordon, NW NE NE 7-14s-34w. Dry. TD 4,742 ft. Miss. 4,642 ft.

Morris County: Pann-Holl 1 Gatch, SW NW NW 17-15s-5e. Dry. TD 2,180 ft.

Ness County: Rooney, Siegfried, Thomas 1 Johnson, SW SW NW 5-19s-25w. Dry. TD 4,660 ft.

Pratt County: Helmerich & Payne 1 McKibben, NE NE NE 17-26s-12w. Dry. TD 4,412 ft.

Trego County: Doley-Wakefield 1 Lindsay, SW SW NE 25-13s-22w. Dry. TD 4,302 ft.

C. Todd 1 Locker, NE NE NW 5-14s-21w. IPP 110 BOPD, Pa. sand 4,026-47 ft. TD 4,162 ft. (Oil discovery.)

NEBRASKA

Cheyenne County, W. Sidney area: Ohio Oil Co. 1 F. Kurz, NE NW SE 4-13n-50w. IP 9,800,000 cu. ft. gas per day, "D" sand discovery—new field. "J" sand 4,782 ft. TD 4,840 ft.

W. R. Edmonson 1 McLaurin, NE SW SW 14-14n-51w. Dry. TD 5,047 ft. Skull Creek 5,007 ft.

NORTH DAKOTA

Foster County, Carrington area: Pure-Continental 1 Carr, NE NE 15-146n-66w. Dry. TD 3,565 ft. Pre-Cambrian 3,556 ft.

Ramsey County: Calvert Exploration 1 Carl

Jack, C NE SW 13-153n-63w. Dry. TD 3,779 ft. Pre-Cambrian 3,255 ft.

CALIFORNIA

Fresno County: Gene Reid Drilling Co. 1 J. K. Wadley-Swearington, 21-17s-18e. Dry. Temblor 6,162 ft., TD 7,332 ft.

Kern County: Barratt & Bysshe 62-22 K.C.L., 22-30s-28e. Dry. TD 6,200 ft.

Coastline Oil Co. 3 Reserve, 22-11n-18w. Dry. TD 1,231 ft.

Humble Oil & Refining Co. 1 T. P. Bacon, 27-28s-20e. Dry. TD 10,674 ft.

Jacobson Oil Co. 1 Stewart, 32-27s-19e. Dry. TD 2,068 ft.

Standard Oil Co. of California 38-1 K.C.L.-31, SE SW 1-29s-26e, IPF 140 BOPD, 18/64-in. choke, 20.5 gravity, perfs. 4,685-4,715 ft., Lerdo sand 4,135 ft., Chanac 4,364 ft., TD 4,717 ft. (New deeper pool discovery on southeast end of Rosedale field.)

Los Angeles County: Bell Petroleum Corp. 1 Granada, 1-2n-16w. Dry. TD 4,001 ft.

Sacramento County: W. W. Holmes, Operator 1 Signal-Artnell-Holmes, 26-6n-4e. Dry. TD 5,134 ft.

San Luis Obispo County: Oceanic Oil Co. A-2-1 C.C.M.O., NW SE 1-32s-22e, IPF 200 BOPD, 13/64-in. choke, 20.9° gravity, perfs. 2,772-87 ft., TD 2,815 ft. (New Republic sand pool in Midway-Sunset field.)

MONTANA

Blaine County, Peoples Creek: Fred R. Munger 1 Government, CS½ SE SW 20-29n-22e. Dry. TD 4,894 ft. Madison 3,980 ft.

Daniels County, Whiskey Butte: Carter Oil Co. 1 S. W. Danelson, C NE SW 12-36n-47e. Dry. TD 9,229 ft. Winnipeg 9,152 ft.

WYOMING

Niobrara County: Quintana Production Co. 1 Spacht, C SW SW 9-33n-66w. Dry. TD 2,811 ft. Bell sand 2,777 ft.

Weston County, S. Black Thunder area: W. R. Blackwell 1 Government, SW SE SW 2-41n-66w. IPF 68 BOPH, Newcastle sand—new discovery. Newcastle 7,368 ft. TD 7,450 ft.

Black Hills Drilling Co., Inc.-Justheim Petroleum 1 Government, SW SE NE 15-42n-65w. Dry. TD 6,519 ft. Newcastle 6,270 ft.

UTAH

Carbon County: Superior Oil 1-17 Government, SE NE NW 17-14s-7e (SLM). Dry. TD 1,460 ft.

San Juan County, Slick Horn Gulch: Don Danvers 1-A Harris, NW NW NW 15-40s-16e. Dry. TD 1,810 ft. Mississippian 1,420 ft.

COLORADO

Adams County: S. D. Johnson 1 B. D. Midlemist "A," NE NW SW 18-2s-57w. Dry. TD 5,780 ft. "J" sand 5,687 ft.

Douglas County, core hole test: Shell Oil Co. 3 Palm CW½ E½ NE 1-10s-68w. Dry. TD 1,600 ft.

Jackson County, Coalmont: L. M. Lockhart, Continental & Northern Pump 1 Fuller, C SE NE 35-7n-81w. Dry. TD 8,116 ft. Morrison 7,563 ft.

Morgan County: E. Kirk Johnson 1 Robinson, C NE NW 7-3n-59w. Dry. TD 6,324 ft. "J" sand 6,202 ft.

SASKATCHEWAN

Edoran-Christie 1 Biggar, LSD 7, 18-36-14w3. Dry. TD 2,590 ft.

H.B.-Tide Water 3 Chaplin Lake, LSD 4, 33-18-6w3. Dry. TD 3,850 ft.

Shell A-9-35 Dahinda, LSD 9, 35-8-23w2. Dry. TD 5,200 ft.

Tide Water-Eyebrow 1 Crown, LSD 1, 20-23-1w3. Dry. TD 3,110 ft.

WILDCAT COMPLETIONS

Cal Standard-Saskatchewan Coop 5-21 Frobisher, LSD 5, 21-2-4w2. Dry. TD 8,336 ft.

Amurex-Albercan 1-1 Moser, LSD 1, 17-14-26w3. Dry. TD 3,333 ft.

Socony-Woodley-Southern 7-12 Pennant, LSD 12, 7-18-16w3. Dry. TD 3,435 ft.

Potash Co. of America 4 Saskatooon, SW¼, LSD 12, 7-36-2w3. Dry. TD 3,330 ft.

Potash Co. of America 5 Saskatoon NW¼, LSD 13, 24-36-3w3. Dry. TD 3,550 ft.

Tide Water-Imperial-Wynot 1 Crown, LSD 16, 18-28-14w2. Dry. TD 2,530 ft.

ALBERTA

Century-Melton-Monarch 2 Acheson, LSD 13, 13-53-26w4. Basal Cretaceous oil well. 7-in. 3,948 ft. TD 5,440 ft.

West Canadian 12-8 North Ashmont, LSD 12, 8-62-10w4. Dry. TD 2,323 ft.

Amurex-Trans Empire 1-13 Laura, LSD 13, 1-24-13w4. Dry. TD 2,999 ft.

Chamberlain 1 Clearwater, LSD 16, 36-34-10w5. Suspended. TD 1,180 ft.

Flock-CPR 2 Denhart, LSD 14, 11-20-11w4. Gas in basal Colorado and Bow Island sand. TD 5,287 ft. PBTD 2,900 ft.

North Canadian-North Pacific-Selby 1 Twin Dome, LSD 11, 12-20-26w4. 7-in. casing set 7,000 ft. Suspended. TD 8,042 ft.

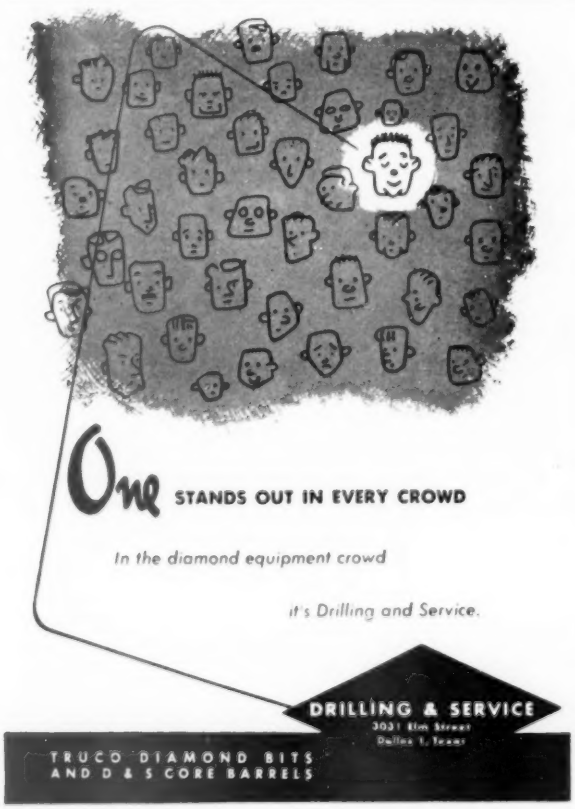
Kroy et al Socony 34-3 CPR, LSD 3, 34-28-22w4. Dry. TD 6,382.

Seaboard-H. B. 7-11 Sunnyslope, LSD 7, 11-31-27w4. Dry. TD 8,611 ft.

Union Oil Co. 12-36 Schultz, LSD 12, 36-11-1w4. Dry. TD 3,459 ft.

BRITISH COLUMBIA

Toad River Joint Project 1, unsurveyed territory. Suspended for winter. TD 4,456 ft.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THE OIL AND GAS JOURNAL

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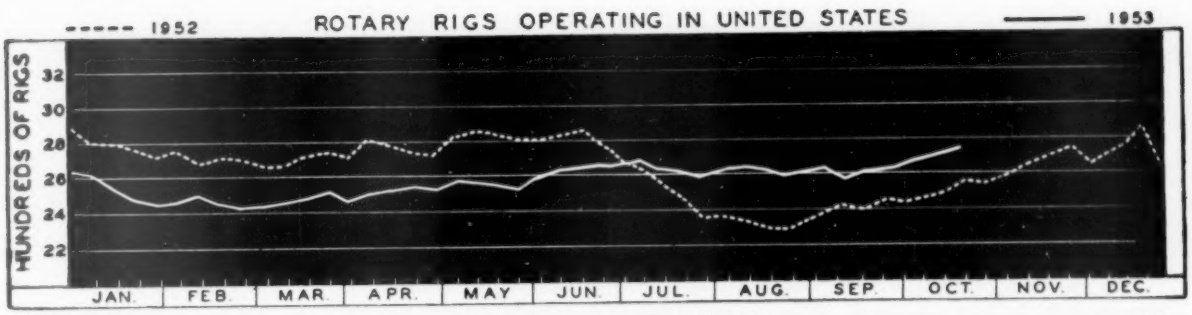
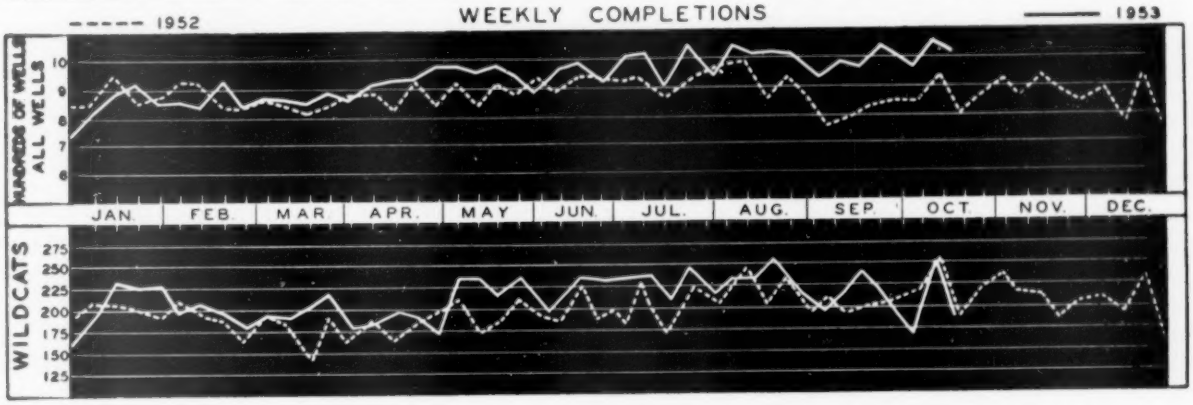




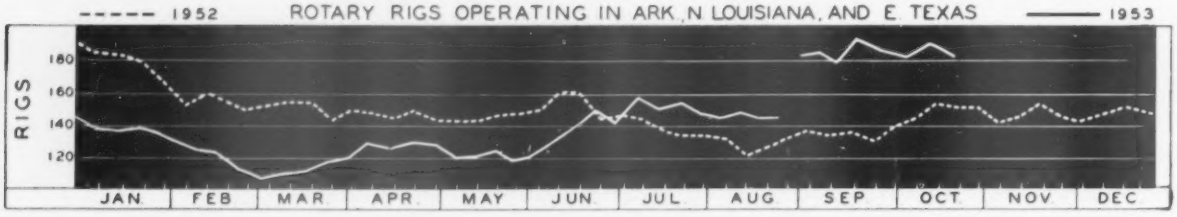
CURRENT STATISTICS

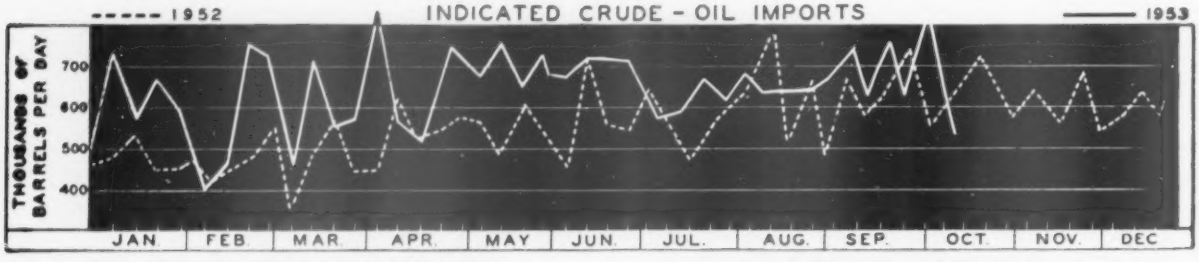
EXPLORATION

WEEKLY WELL COMPLETIONS . . . WEEK ENDED OCTOBER 17, 1953

	Total of all wells					Oct. 17		Wildcat completions and discoveries					Cumulative total, 1953				
	Comp.	Oil	Gas	Dry	Footage	1953	1952	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	16	8	0	*8	23,500	603	648	0	0	0	0	0	0	0	0	0	0
Pennsylvania	40	21	2	†17	67,757	1,509	1,599	0	0	0	0	0	0	0	3	12	15
West Virginia	15	1	11	3	37,625	493	473	0	0	0	0	0	0	0	9	5	14
Ohio	23	9	4	10	41,511	855	830	0	0	0	0	0	2	0	3	13	18
Indiana	24	11	2	11	40,048	1,028	1,008	0	0	0	7	7	12	0	2	284	298
Kentucky	19	5	0	14	30,340	893	1,031	0	0	0	6	6	8	0	1	154	163
Illinois	67	36	0	31	177,089	1,589	1,657	0	0	0	9	9	5	0	0	331	336
Michigan	15	7	0	8	27,820	484	557	1	0	0	8	9	15	0	5	202	222
Kansas	108	48	15	‡45	352,440	3,876	3,650	1	0	0	9	10	77	0	30	601	708
Nebraska	5	2	1	2	25,731	260	237	0	0	1	1	2	14	0	5	108	127
Oklahoma	147	80	6	‡61	481,764	5,897	4,578	1	0	0	5	6	98	6	27	486	617
Texas	312	162	12	138	1,485,581	13,585	13,962	9	1	2	82	94	703	49	143	3,336	4,231
North Central (Dist. 7-B & 9)	112	53	0	59	411,859	5,119	4,481	6	0	0	28	34	367	0	16	1,340	1,723
West (Dist. 7-C & 8)	62	40	0	22	350,196	2,960	4,239	1	0	0	15	16	148	2	12	540	702
Panhandle (Dist. 10)	1	1	0	0	3,030	616	539	0	0	0	0	0	0	2	0	16	18
Eastern (Dist. 5 & 6)	24	17	4	3	111,886	638	650	1	0	0	2	3	19	2	5	214	240
Gulf Coast (Dist. 2 & 3)	52	27	3	22	304,992	1,991	2,121	1	1	1	13	16	87	20	57	529	693
Southwest (Dist. 1 & 4)	61	24	5	32	303,618	2,261	1,932	0	0	1	24	25	82	23	53	697	855
Louisiana	57	26	5	26	348,292	2,108	1,821	1	1	0	9	11	66	30	19	296	411
Northern	29	9	3	17	108,120	893	986	1	0	0	7	8	9	2	2	121	134
Southern	28	17	2	9	240,172	1,215	835	0	1	0	2	3	57	28	17	175	277
Arkansas	8	3	0	5	34,096	423	315	0	0	0	1	1	11	0	0	98	109
Mississippi	13	7	0	6	82,133	296	280	0	0	0	4	4	12	1	4	133	150
Southeastern States	1	0	0	1	3,690	116	53	0	0	0	1	1	1	0	0	96	97
Montana	11	7	1	3	41,995	338	246	0	0	0	2	2	12	0	0	83	95
Wyoming	23	20	0	3	117,349	616	518	1	0	0	2	3	21	0	3	109	133
Colorado	13	6	1	6	67,432	547	355	0	0	0	4	4	24	0	10	240	274
Utah	3	0	0	3	3,636	53	61	0	0	0	2	2	2	0	4	30	36
New Mexico	35	18	12	5	168,733	1,117	829	1	0	0	2	3	18	1	14	100	133
California	46	39	0	7	210,530	2,029	1,927	2	0	0	7	9	53	0	8	454	515
North Dakota	8	6	0	2	58,003	206	81	0	0	0	2	2	8	0	0	53	61
Miscellaneous (Tenn.)	4	1	0	3	4,466	69	90	0	0	0	2	2	1	0	4	41	46
Total United States	1,013	523	72	418	3,931,561	38,990	36,806	17	2	3	165	187	1,163	87	294	7,265	8,809
Total previous week	1,059	549	84	426	4,112,377			34	4	9	204	251	1,146	85	291	7,100	8,622
Total October 18, 1952	801	378	67	356	3,088,101			25	1	4	157	187	1,126	68	200	6,852	8,246

Service wells included: *8, †15, ‡2.

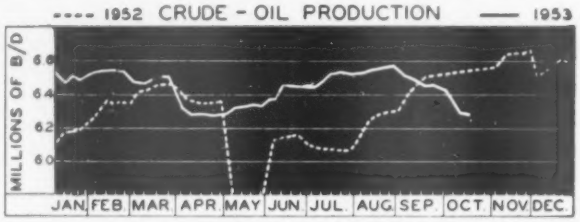


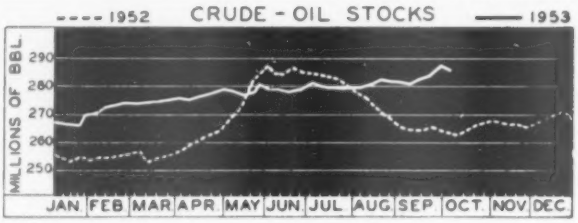


DAILY AVERAGE PRODUCTION FOR WEEK

	October 17 Crude oil	October 17 Lease condensate	October 17 Total	Oct. 10 total
Alabama	4,800		4,800	5,000
Arkansas	78,500	450	78,950	77,100
California	998,600		998,600	999,200
Colorado	104,800		104,800	105,500
Eastern	60,000		60,000	60,000
Florida	1,550		1,550	1,550
Illinois	165,400		165,400	165,900
Indiana	32,400		32,400	34,700
Kansas	304,100		304,100	305,400
Kentucky	32,300		32,300	32,700
Louisiana	598,250	40,300	638,550	637,600
North	106,400	2,800	109,200	108,250
South	491,850	37,500	529,350	529,350
Michigan	32,400		32,400	32,600
Mississippi	91,600	3,250	94,850	94,500
Montana	32,700		32,700	33,500
Nebraska	12,600		12,600	14,100
New Mexico	204,075	550	204,625	204,525
Oklahoma	517,900		517,900	523,400
Texas	2,692,175	46,200	2,738,375	2,738,375
Dist. 1	38,575	350	38,925	38,925
Dist. 2	145,625	5,100	150,725	150,725
Dist. 3	434,600	24,150	458,750	458,750
Dist. 4	254,375	5,700	260,075	260,075
Dist. 5	47,500	400	47,900	47,900
Dist. 6	122,875	5,000	127,875	127,875
East Texas field	244,500		244,500	244,500
Dist. 7-B	117,950	50	118,000	118,000
Dist. 7-C	163,250	4,150	167,400	167,400
Dist. 8	862,225	900	863,125	863,125
Dist. 9	185,325	350	185,675	185,675
Dist. 10	75,375	50	75,425	75,425
Utah	4,500		4,500	4,700
Wyoming	211,100		211,100	212,000
North Dakota	13,900		13,900	14,100
Total U. S.	6,193,650	90,750	6,284,400	6,296,450
Change from previous week, down			12,050	
Canada	205,150		205,150	205,150
Total U. S. production January 1-October 17			†1,887,934,775 bbl.	
Same period last year (crude plus cond.)			*1,800,336,050 bbl.	

*Includes 24,691,835 bbl. condensate. †Revised.



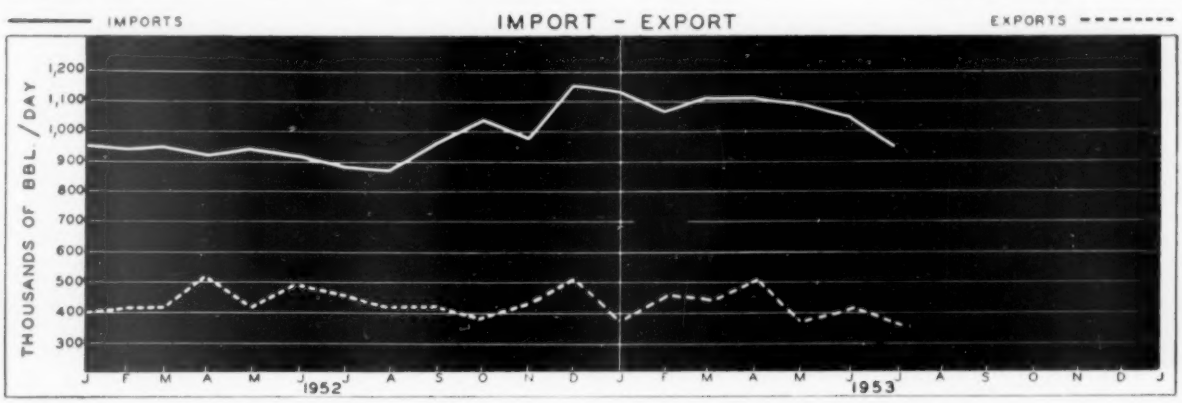


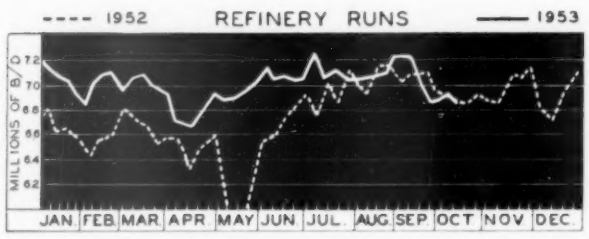
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

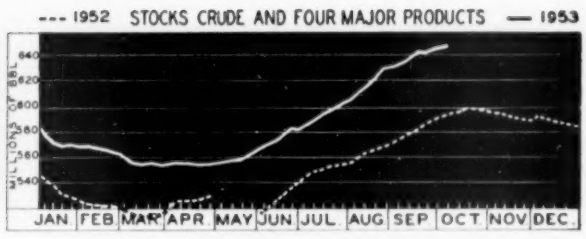
(Thousands of barrels)

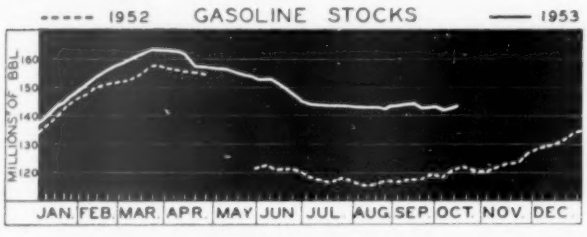
	Oct. 10, '53	Oct. 3, '53	Oct. 11, '52
Pennsylvania Grade	2,853	2,809	2,308
Other Appalachian	2,181	2,141	2,172
Illinois, Indiana, Michigan	12,274	12,617	12,086
Arkansas	3,364	3,258	2,866
Louisiana	17,481	16,997	16,024
North	2,955	2,699	2,488
Gulf	14,526	14,298	13,536
Mississippi	3,657	3,636	3,333
New Mexico	9,057	9,394	7,540
Oklahoma and Kansas	42,462	42,366	38,697
Texas	132,777	133,460	125,687
East Texas	11,909	11,866	12,367
West Texas	58,699	59,377	56,749
Texas Gulf	28,910	28,211	25,776
Other Texas	33,289	34,006	30,795
Rocky Mountain	16,440	16,497	14,471
California	33,038	32,947	30,916
Foreign	†10,579	11,646	6,954
Total	286,163	287,768	263,054

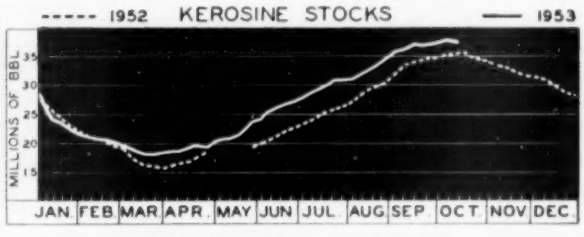
*Bureau of Mines. †Includes 3,528,000 bbl. in California.

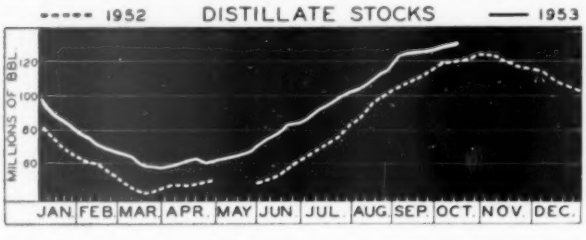


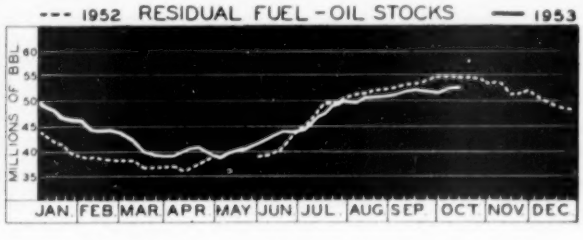










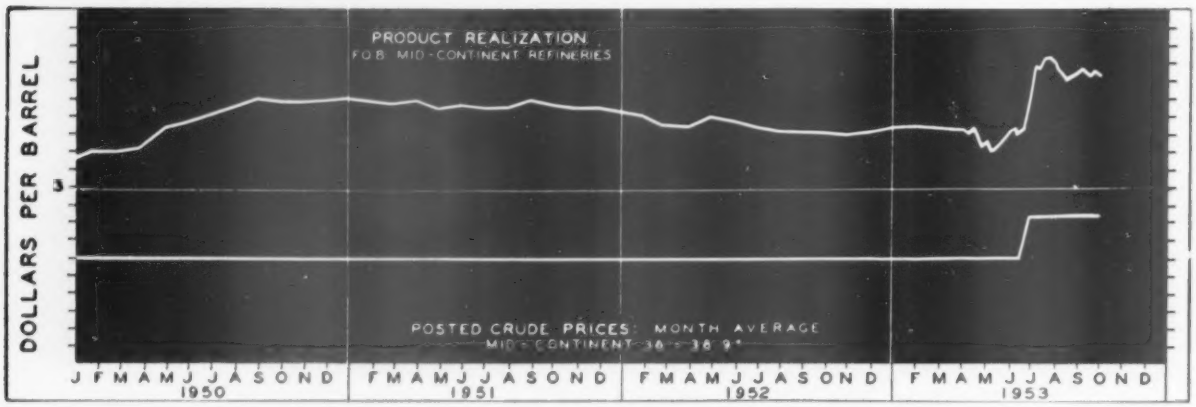


A.P.I. REFINERY REPORT, OCTOBER 17

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, October 1952 — Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,037	433.4	46.0	267.3	210.0	33,376	15,040	47,923	13,312	1,045	422.7	44.7	254.9	219.6
Appalachian:														
District 1	111	54.4	6.0	18.6	17.1	3,911	584	1,602	759	97	40.8	5.9	17.2	13.9
District 2	67	52.6	4.0	13.8	12.7	1,834	658	662	121	87	40.7	6.7	13.1	13.9
Ind., Ill., Ky.	1,281	709.4	83.9	235.6	169.0	27,111	9,467	23,818	4,806	1,244	674.6	73.6	220.5	159.0
Okla., Kans., Mo.	607	340.3	15.4	147.6	51.0	14,499	2,499	12,645	1,237	565	324.9	11.4	136.6	58.0
Inland Texas	257	189.4	11.6	39.6	30.3	5,750	622	2,481	1,425	265	180.0	12.8	41.4	36.9
Texas Gulf Coast	1,571	797.3	133.6	398.8	217.1	20,318	4,453	16,478	7,254	1,746	780.6	117.5	405.3	268.6
La. Gulf Coast	561	278.6	68.3	150.0	38.3	7,992	2,936	7,386	1,453	525	269.2	61.1	131.0	54.8
N. La. and Ark.	85	37.3	6.3	15.0	6.6	3,070	742	650	130	85	34.4	7.6	21.5	7.0
Rocky Mountain:														
New Mexico	19	12.4		3.0	3.7	152		46	28	18	11.2	0.7	2.9	4.1
Other Rocky Mtn.	240	112.1	3.1	52.6	39.3	4,729	286	2,743	1,011	205	99.2	5.1	39.4	39.6
California	1,030	448.9	4.4	142.8	385.3	20,054	366	14,468	21,567	1,001	422.5	5.1	173.7	328.5
Oct. 17, 1953	6,866	3,466.1	382.6	1,484.7	1,180.4	142,796	37,653	130,902	53,103	6,883	3,300.8	352.2	1,457.5	1,203.9
Oct. 10, 1953	6,941	3,432.9	368.9	1,448.9	1,208.6	142,517	37,756	129,226	53,341					
Oct. 18, 1952	6,898	3,307.4	371.0	1,454.7	1,202.4	122,002	34,568	120,937	54,450					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
3
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 36 - 38 9°
J F M A M J J A S O N D
1950
F M A M J J A S O N D
1951
F M A M J J A S O N D
1952
F M A M J J A S O N D
1953

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate and fuel oil. Realization averaged $3.63 for week ended October 10, $3.67 for previous week, and $3.33 for October 1952. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of October 21, 1953. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	11.125-11.625	13-13.8	11.125-11.75
Premium gasoline	12.125-12.625	14.5-14.8	12.25-12.75
42-44 w.w. kerosine	8.875-9.25	10.4-10.9	8.875-9.5
No. 2 straw fuel oil	7.875-8.25	9.4-9.9	8.25-8.5
No. 6 residual	$1.25-1.35	$2.25-2.40	$1.85-1.90

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.5	5.0	5.25
Grade 18-55	6.6	6.10	6.35

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13.75
750 vis., No. 3-4 neutral	16.75
2,000 No. 5-6 neutral	18-18.75

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	20.5-21.5
200 vis., No. 3 neutral, 0-10 pp.	14.5

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	25.5
180 vis., 10 p.t. neutral	27.5

WAX

Mid-Continent

132-134 A.M.P.	6.0

WARMER than normal weather and excessive inventories of finished gasoline combined to depress the natural-gasoline market enough to break the price at a time when the market is normally gaining strength.

For several weeks pressure has been developing on the market in Texas. Part of this has been due to the soft motor-fuel market on the Gulf Coast and part to the fact that gasoline sold locally had to be held nearer to summer specifications because of the unseasonably warm weather.

First sales at lower prices were reported for Grade 26-70 on the North Texas market on October 14. The cut was from 5.875 cents to 5.375. On October 15 another drop was reported for North Texas to 5.0 cents a gallon. Also on October 15, Grade 26-70 on the Group 3 market dropped 0.5 cent to 5.875 cents. On October 20 there was a spread on the Group 3 market with quotations ranging downward from 5.875 to 5.5 cents. Normal differentials were established by October 21 with Group 3 at 5.5 cents and North Texas at 5.0 cents.

Continued strength is reported for heavy fuel on the Group 3 market with no spot material reported moving below $1.25 per barrel. Residual prices are very firm on Gulf Coast and East Coast markets.

Some shading of gasoline prices, particularly on the lower grades, is reported for most of the important market areas. On the Gulf Coast, most suppliers continue to quote a low of 11.25 cents for regular gasoline in cargo lots, but material is freely available at 11.125 cents.

Most contract prices for gasoline moving out of the Mid-Continent are based on 11.375 cents Group 3, but even at pipe-line terminals, material is available at 0.25 cent under this posting plus pipe-line charges. Gasoline sales have been good but not high enough to work off excessive inventories that have disturbed the market.

CRUDE PRICES GRAVITY SCHEDULE

	Signal Hill, Calif.*	Okla-homa, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87			
15-15.9	1.93			
16-16.9	1.99			
17-17.9	2.05			
18-18.9	2.11			
19-19.9	2.18			
20-20.9	2.24	$2.50		$2.37
21-21.9	2.30	2.52		2.39
22-22.9	2.37	2.54		2.41
23-23.9	2.45	2.56		2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9		2.76	3.09	2.63
34-34.9		2.78	3.11	2.65
35-35.9		2.80	3.13	2.67
36-36.9		2.82	3.15	2.69
37-37.9		2.84	3.17	2.71
38-38.9		2.86	3.19	2.73
39-39.9		2.88	3.21	2.75
40 and above		2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast. ‡Includes New Mexico Permian.

Prices East of California effective June 15, 1953. California prices effective February 16, 1953. Pennsylvania Grade prices effective September 21, 1953.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.05
Southwest Pennsylvania	3.61
West Virginia	3.55
Ohio	3.54
Illinois Basin	3.02

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FOR SALE at our Oklahoma City warehouse: One used Allis-Chalmers, Model UM single drum tractor well servicing unit mounted on rubber tires. No mast or tools. $850.00. Cities Service Oil Company, Patridge, Bartlesville, Oklahoma.

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Complete Rotary Rig Equipped W/Wilson Giant Single Engine Draw Works, GM Twin-Diesel Engines, 7 X 12 8000 Series Wheeland Mud Pump, 96' Lee C. Moore Cantilever Mast, 8' X 24' American Steel Doghouse, 5000' of 3½" Drill Pipe W/Hughes Flash Weld Tool Jts.; 7⅝" Model EW American Overshot complete W/Slips and complete with miscellaneous Tools.

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FOR SALE: At Oklahoma City 2700' 9" OD 40# used J-55 Seamless Steel Casing, 8-V thread ST&C, $3.00 per foot. Also 3500' 9" OD 46.10# LT&C. Ditto $3.60 per foot. Cities Service Oil Company, Patridge, Bartlesville, Oklahoma.

FOR SALE: 10,000'—4½" drill pipe, with tool joints cut off, located at Hobbs, New Mexico. Makin Drilling Company, Box 1628, Hobbs, New Mexico.

EVERYTHING in new and used equipment for well drilling. Fishing tools rented. Save money, get quotations from Pressey & Son, Pueblo, Colorado.

NOW! . . . A NEW POWER TOOL for one man hole digging and anode planting. Ask about low-priced super Hole-A-Matic hole digging machines, or Super Hole-A-Minit attachments for SKIL drills at your SKIL dealer or any contractors' supply . . . or write to MULTIMATIC CORPORATION, Box 2143, So. Annex, Van Nuys 5, California.

FOR SALE: Failing Model 1500 drilling equipment. Have available for sale several drills exceptionally complete and in excellent condition. Particularly suitable for water well or deep core work. This equipment relatively new and now operating. Substantial savings possible. Box G-738, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY AND GASOLINE PLANT EQUIPMENT

11—Griscom-Russell 21-6-144, Style FST Gas Coolers, single pass shell, two pass tubes, 250# WP.
2—Same as above, only 500# WP.
6—Coynco T-144 Atmospheric Cooling Sections, 750 sq. ft. each, 125# WP.
3—Vertical Gas Scrubbers (1) 250# WP, (2) 500# WP.
1—7' 6" x 72' x 1¼", no trays, tower.
2—Goulds Centrifugal Pumps, 2500 GPM, 25' Head, direct connected to 15 HP Explosionproof Electric Motors, 1750 RPM.
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EQUIPMENT FOR SALE

FOR SALE at Okla. City whse., 1 used 8" x 3¼" x 8" Ingersoll-Rand type 20 high pressure, 2 stage portable compressor. Serial #PP71898 driven by model GU2S 5⅜" x 6¼" Waukesha engine Serial #76426 mounted on steel wheels. Price $1500.00. Cities Service Oil Co., Patridge, Bartlesville, Oklahoma.

FOR SALE: 1 Montgomery 3 axle lowboy with International Tractor. Contact Mr. Wm. Bingman, P.O. Box 281—Telephone 5877, Carmi, Illinois.

FAILING model heavy duty 1500 drill and water truck. Write to Box 819, Longmont, Colorado, for details.

FOR SALE: At Bartlesville, one used Mayhew 1000 rig, purchased new in 1947 and mounted on 1½ ton 1947 V-8 Ford Coleman truck, engine #799-T 1547975, 3 speed auxiliary transmission ahead of rotary table, 3 speed Mayhew power take off, 4 wheel Coleman conversion drive, 8:25 x 20 10-ply tires all around, drill is chain pull down mechanical type, equipped with square Mayhew kelly, 4½" x 6" Gardner-Denver mud pump, 120' 2⅜" drill pipe with tool joints. Montana and Louisiana 1953 tags on unit. One spare tire. $6500.00. Cities Service Oil Company, Patridge, Bartlesville, Oklahoma.

FOR SALE: Approximately 3600 ft. of 4½" 16.60# drill pipe with Hughes Flash-weld extrahole tool joints. Model BC-6, 200 ton Emsco Swivel. Melton Supply Company, Box 1360, Seminole, Oklahoma.

FOR SALE: FOUR Cardwell K-Model Pulling Units complete and in good operating condition; also ONE Cardwell Mobilhoist with spudding attachment, double-pole mast, drill and sand lines, with tools. All equipped with Waukesha Engines. JAMES OIL WELL SERVICE, Hobbs, N. M. Dial 3-2331. P. O. Box 2196.

CABLE TOOL AUCTION SALE

MONDAY, NOV. 2ND., 9:30 A.M.

Oil, Gas and Water Well Tools, $100,000 sale Drilling Rigs, 3 National Machines, 1 Star drilling machine, 150 drill bits, 75 items, 50 bailers, OCS sand reels, 3 drilling engines, two with diesel or oil heads, clutches, truck winches, 4x4 front drive truck, pole trailers, $20,000 good fishing tools. Inspection after Oct. 26th. Free parking. Lunch on grounds. DAWKINS BROS., Auctioneers. Thousands of bargains.

TRI STATE TOOL & SUPPLY CO.
Box 827—Phone 7-5121
"Everything in Cable Tools"
3600 to 4000 Jefferson St.
Just off 36th St.
PARKERSBURG, WEST VIRGINIA

EQUIPMENT FOR SALE

FOR SALE: Rotary rig, Cardwell Model R draw works complete with rotary drive Waukesha pump and motor cable attachment and tool shed. Good for 5,000-foot depth. Could be seen in Oklahoma City. C. G. Lucenti, % Pioneer Mfg. Co., Inc., 2352 W. Cermak Road, Chicago 8, Ill.

FOR SALE: 5—Shriver 42"x42" cast iron Filter Presses, Plate & Frame Type, 27, and 54 chambers 1" cake; 15—Sperry 18"x18" cast iron Filter Presses, 11 chambers; #12 Sweetland Filter for 72 monel covered leaves on 2" centers. Immediate shipment. Attractively priced. Consolidated Products Co., Inc., 17-20 Park Row, New York 38, N. Y. BArclay 7-0600.

JOY 300 Drilling Rig, butane powered, mounted on Brockaway 6x6 truck, 3500 feet 3½ inch drill pipe. Auxiliary mud pump and butane engine as separate unit. All tools and equipment included. This rig in first-class working condition and ready to go to work immediately. Call or write Steele Brothers, Crete, Nebraska. Phone 127.

SULLIVAN 200—Mounted on New Tandem International, complete with all tools. For price and inventory contact—Fleming, 2216 Greenway Blvd., Wichita, Kansas. Phone 5-7717.

FOR SALE: Used 22-W and 24-L Bucyrus-Erie Spudder. Write or call Beacon Supply Company, Box 606, Farmington, New Mexico. Used 36-L Bucyrus-Erie Spudder, Beacon Supply Company, Box 398, Pampa, Texas.

FOR SALE: At our East Chicago refinery one used 300 hp. Type T2RA Moore steam turbine, 2250 RPM, SMT 150#, exhaust 15#, Serial #3991. Price $1000.00. Cities Service Oil Company, Patridge, Bartlesville, Oklahoma.

USED EXCELLENT CONDITION IN OPERATION

One Each (4¾" to 1") (8⅝" to 2⅜") (13⅜" to 4½") LANDIS Leadscrew Receding Head Pipe Threading and Cutting Machine Motor Driven.

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600'—18" O.D., ⅜" Wall. Like new.
10,000'—7" O.D. Good Used Casing, 20# Lap.
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8,000'—3½", 10,000'—2¼", and 10,000'—2" O.D. Number one used, seamless, beveled for welding. Ideal for oil, gas, or water lines.

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1—Type X G.M.A. Bessemer Twin
1—Type X G.M.B. Bessemer Twin
1—Type 80 Cooper Twin
20—Compressor Cylinders, various sizes and pressures. Will sell any of the above as is or completely repaired.

W. S. SMITH
205 Thompson Bldg., Tulsa, Oklahoma
Phone 2-5473

PIPE-LINE EQUIPMENT

We own and are dismantling all the pumping stations on the original Humbolt to Chicago pipe line. We offer for sale at bargain prices diesel engines, pumps, steam engines and steam pumps. A. C. and D. C. motors, generators, and controls of all sizes. A large quantity of 6"—8"—10" and 12" valves and many other items too numerous to mention. Write or wire us stating type of equipment in which you are interested, and descriptive list will be mailed promptly. Address

SUMMER & CO.
3937 Main Street, Kansas City, Missouri
Phone Jefferson 6400

EQUIPMENT FOR SALE

STORAGE tank, 1100 bbl. capacity, ¼ plate, riveted, upright 20' x 21'. Number one condition. Easy to load cars or truck. $1000.00. M. J. Regan Pipe Co., Coffeyville, Kans.

FOR SALE, near Maud, Okla.: One used erected 5,000 bbl. BS&B open top, flat seam bolted tank, used for fresh water. Price $1250.00. Cities Service Oil Company, Patridge, Bartlesville, Oklahoma.

SULLIVAN 200, trailer mounted, complete with all tools, contact for inventory and price. Mesker Drilling Company, Box 6157, Tulsa. Phone 5-9357.

REDA PUMP complete w/#4—20 Motor, 45½ H.P., 650 Volt, 41.6 Amps. #90—Pump Housing, #5595—Switchboard w/recording Ammeter 3400'—#4 Cable 125 Amp. Auto Transformer Accessories. Engine 225 H.P. Climax Type R-225 on Skid. Alternator G. E. 125—KVA, 100 KW, 440 V. A. C. w/Transformer, Flexible coupling and skid base. House—10' x 18' wood frame, w/G.I. Roof and Siding on Skid. Engine—165 Hp. Climax R-61 on Skid. Herndon Drilling Co., 421 Mayo Bldg., Tulsa, Phone 4-9700.

SALES and rentals of cable drilling and fishing tools, casing and equipment, from the Southwest's largest stock of used cable tools and oil field supplies. Degen Pipe and Supply Co., Tulsa, Oklahoma.

11,000' 2" EUE 8rd. A1 Used Tubing. 8000' 4½" Electrically tested Drill Pipe. 3000' 3½" Drill Pipe. Used tubular goods available at all times. Phone 477, Giffin & Thompson Supply, Hoisington, Kansas.

6000' 3" seamless line pipe 35 to 40' random lengths. No. One 30c. 750' 5½ seamless casing. 11½ thread. 6" couplings single random lengths. $1.25. M. J. Regan Pipe Co., Coffeyville, Kans.

FOR SALE: 24 W Bucyrus Drilling Machine, 1945 Model, V Belt drive, semi mounted on 750 duels, leaf springs with vacuum brakes, $5200.00. With following available Tools, 1950—2 ton Cabover Chev. truck, 1100' of ¾ drill line & ⅞ sand line, water tank, chain tongs, & numerous hand tools, 200 amp welding machine built into rig, complete $9000. A. & B. Drilling Co., Scobey, Montana.

FAILING MODEL 1500—on contract with major client in Montana. Write for details to Box G-703, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: One Long Horn Trencher with 12" cutting buckets in excellent condition. Available for immediate delivery. Contact Modern Welding Company, P. O. Box 5008, Tulsa 16, Oklahoma, or Morder Welding Company, P. O. Box 528, Owensboro, Kentucky.

FRANKS Double Drum Spudder mounted on 8-ton International converted from gasoline to diesel. Good rubber. Capable of drilling or tailing-in to 4000'. Now carrying 3500' good ¾" wire. Mounted measuring line and meter. 53' 10 to 8 telescope pole. Ready to drive away. Call or write R. L. Orr, 930 West First St., El Dorado, Kansas. Phone 1444, if no answer 591 Caney, Kansas.

EQUIPMENT WANTED

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

INTERESTED in buying good used flat belts. Also parts for Superior and Black Bear Engines, new or used. Texas Consolidated Oils, Box 656, Cement, Oklahoma. Tele. 2521.

INTERESTED in any amount 2⅞ double pin Hydril pipe. Must be in good condition. Box G-724, The Oil and Gas Journal, Tulsa, Oklahoma.

NOTICE: We buy. We sell equipment everywhere. If you want to sell or buy contact Pressey & Son, Pueblo, Colorado.

EQUIPMENT NOT IN USE: Did you find a buyer in this column for the equipment you have for sale. Someone wants it and an "Equipment For Sale" classified advertisement in the Journal will find a buyer. See box heading for classified rates or write The Oil and Gas Journal.

HELP WANTED

GEOLOGIST WANTED: Fast growing Mid-Western independent (operating nationwide) needs petroleum geologist. Prefer recent graduate with some major company experience. Must be interested in new scientific survey methods and willing to study and promote program based on latest methods. Must be capable of organizing and directing geological department when required. Excellent ground-floor opportunity for right man. State age, education, experience, salary expected, and other details first letter. Replies strictly confidential. Box G-736, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST: Wanted experienced SEISMIC SUPERVISOR for location in Rocky Mountains. Must have degree in related subject with at least 8 years' experience. In reply please give complete experience and education. Replies confidential. Box G-714, The Oil and Gas Journal, Tulsa, Oklahoma.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

LANDMAN—Title, Rental, Division Order and Utilization experience—6½ years with major oil company. Desires change to expanding independent. Now in Gulf Coast Area. Can relocate and travel. BS degree. Age 29. Box G-737, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED refinery superintendent for Midwest independent refinery. Chemical engineering desirable. Initial letter application should set out past experience in detail, education and salary requirements. Replies strictly confidential. Box G-743, The Oil and Gas Journal, Tulsa, Oklahoma.

Micropaleontologist

Preferably with an advanced degree and a minimum of 5 years' commercial or academic experience. To work in the New York research laboratory of a major oil company. This position demands broad interests in Stratigraphy and Biofacies and the capacity to do independent work on projects assigned. Salary dependent on experience and qualifications.

Write giving personal history and work experience. Please include telephone number.

RECRUITING SUPERVISOR

BOX OGJ

Arabian - American Oil Company

505 Park Avenue
New York 22, N. Y.

Engineers needed for development, field and sales work in Rky. Mtns., W. Texas and Calif. with expanding service company. Experience not necessary. State qualifications and salary expected. Photo desired. Write

BJ SERVICES, INC.
6505 Paramount Blvd.,
Long Beach 5, California

HELP WANTED

CHEMICAL ENGINEERS (2) — with petroleum refinery experience, including fluid catalytic cracking, and familiarity with catalyst testing and laboratory technique, for sales or technical service. All replies will be considered as confidential. Apply Box G-753, The Oil and Gas Journal, Tulsa, Oklahoma, stating age, qualifications, and salary requirements.

SEISMIC SUPERVISOR required by expanding and aggressive seismic contracting company. Should have ability to supervise any domestic area and have good professional contacts. Minimum requirements; college degree in geophysics or related fields and eight years' seismic experience. Good future. Tulsa location. Box G-705, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING ENGINEER

SOUTH AMERICA

Major oil company affiliated with Standard Oil Company (New Jersey) has an attractive staff position available for qualified engineer.

Must have engineering degree and several years' responsible drilling engineering experience. Duties will include mud control, penetration tests, cost estimates, drilling equipment studies, etc.

Write giving age, marital status, education and detailed experience resume.

Box 308-N

Radio City Station

New York 19, N. Y.

HELP WANTED

GRADUATE Chemists and Chemical Engineers with or without experience for positions in Research and Development department, located in Tulsa. State qualifications and salary expected. Write Personnel Department, P.O. Box 381, Tulsa 2, Oklahoma.

OIL Industry Employment Service, 405 Tuloma Bldg., Tulsa, Okla. 4-5974. Tom Robinson, owner. For Technical and Trained Personnel, including LPG.

SOUTH AMERICA. These jobs are with one of the better oil companies. Our fee paid. Mechanical Engineer — graduate, no experience required. Petroleum Engineer—graduate, no experience required. Chemical Engineer—graduate, no experience required. Mud Technician—two or more years' experience, single. Accountant—college graduate, Accounting major, single. All information confidential and should be mailed to CHAS. J. LOVELESS PERSONNEL SERVICE, 616 S. Main, Tulsa, Oklahoma. Phone 3-5168.

SALES ENGINEER: To represent well known valve manufacturing company. Must be college graduate, married, age 28 to 35. Willing to headquarter in Pittsburgh, Pennsylvania, and free to travel eastern states calling upon refineries, petrochemical plants, oil and gas producing companies and utilities companies who produce and distribute natural gas. Job is salaried with automobile and reasonable expenses allowed. Prefer someone with knowledge of valve applications and above type plants. All replies confidential. Furnish small photograph with application. Box G-741, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED FOR EMPLOYMENT: Petroleum Engineer or Geologist with two or three years' experience in Louisina Gulf Coast. Duties will entail preparation and maintenance of detailed structure and isopach maps of south Louisina fields and evaluations necessary in field studies. Work located in New Orleans with reliable and financially strong concern. Reply giving age, experience in detail and salary desired. Inquiries will be kept strictly confidential. Our employes know of this ad. Box G-713, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

MECHANICAL Engineer — familiar with the design and manufacture of oil field equipment—experienced in machine shop and foundry operations. Administrative and sales ability helpful. Graduate preferred. Give full details of past experience, references, and salary expected. Replies held confidential. Write Box G-746, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGISTS

SUBSURFACE

With degree in Geology and a minimum of 3 years' subsurface experience on deep wells. To work in Saudi Arabia on deep wells making lithologic and faunal logs from cores and cuttings, interpreting electrical logs and working on field and regional stratigraphic studies. Salary commensurate with experience and qualifications.

JUNIOR

Recent graduate with B.S. in Geology with knowledge of micropaleontology and subsurface methods. Experience desirable but not essential.

Write giving personal history and work experience. Please include telephone number.

RECRUITING SUPERVISOR

BOX OGJ

Arabian-American Oil Company

505 Park Avenue

New York 22, N. Y.

GRADUATE MECHANICAL ENGINEER

under 40 with at least 5 years experience in oil production to head sales promotion and advertising department of oil field equipment manufacturer.

Write

Box G-754,

THE OIL AND GAS JOURNAL

Tulsa, Okla.

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CHEMICAL DEGREE + 5 YEARS EXP. IN PETROLEUM ENGINEERING LAB

Base Salary up to $600 Month Depending on Exp. & Education. (To 35 Years of Age)

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WRITE: C. L. Laue,

26 Broadway, New York 4, N. Y.

SITUATIONS WANTED

DRILLING Contractor Contact Man: Extensive experience in drilling completion. Canada, Rocky Mountain, and Gulf Coast. Box G-740, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 1628, Ph. No. 3-3141, Hobbs, New Mexico.

DRLG. SUPT.: Nine years' experience, all phases drilling and well completion, Gulf Coast, offshore, Mid-Cont., Okla., Kans., Colo., Neb. & Wyo. Plus one year in South America. Dual and triple zone well completion and reservoir engineering. Have been in oil work since 1934. Graduate Petroleum Engineer. Box G-731, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER, B.S., 19 years design & Service Co. experience, desires position with a challenge. Box G-756, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST AND ENGINEER. 20 years experience in primary and secondary recovery operations throughout the United States. Wishes new connection. Box G-755, The Oil and Gas Journal, Tulsa, Oklahoma.

MAJOR company drilling superintendent experienced in drilling, completion and production of oil and gas wells in the Mid-Continent area seeks operating position with progressive organization which can more fully utilize latent abilities. Engineering background, 36, married. Box G-732, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

MECH. ENGINEER: 12 years' refinery experience. 4 years in eng. design; 8 years in plant operation & maint. 37 years old, married. Desire responsible position with Engineering Co., Southwest preferred location. Box G-753, The Oil and Gas Journal, Tulsa, Oklahoma.

EXECUTIVE MANAGEMENT — Exploration Programs (geological, land, drilling), engineering graduate, age fifty, wide experience, recently Kansas. Will consider retainer and participation, or straight salary. Box G-744, The Oil and Gas Journal, Tulsa, Oklahoma.

AREA SALES MANAGER. Drilling and completion equipment. Ten years' actual field experience. Box G-739, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM geologist and engineer having substantial managerial experience in production and exploration desires position offering opportunity and enterprise. Box G-721, The Oil and Gas Journal, P.O. Box 1260, Tulsa, Oklahoma.

ATTENTION Permanent Independents and Reliable Investment Groups: PRACTICAL OIL GEOLOGIST locating in Denver about Nov. 1. Age 30. 5½ years with major company in Texas, La., New Mexico, and Western Colorado. Native of Oklahoma. Personal and business contacts throughout the Rockies, Mid-Continent and Texas. Bachelors and Masters degrees. Experienced at field development; conceiving, supervising and executing local and regional structural and stratigraphic studies; and training geologic personnel. Expert sample man and well sitter. References. Desire full or part time consulting position which includes opportunity to participate. Write Box 95, Denver, Colorado.

EXPERIENCED GEOLOGIST: Eight years' experience in North Texas, West Texas and Mid-Continent Areas. Fully qualified to conduct a successful exploration and development program for small company or independent. Was formerly district geologist for major oil company. Box G-752, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING OR PRODUCTION Superintendent, Graduate Engineer, age 42, recently in charge of major company tools, until company discontinued its drilling department, would like job with independent operator. Experienced in Gulf Coast, Permian Basin, Rocky Mountains, and Mid-Continent Areas. Have also done contact work and am experienced in "bidding in" rotary contracts. Box G-751, The Oil and Gas Journal, Tulsa, Oklahoma.

LAND—LEASE—TITLEMAN—Licensed attorney well experienced in field and office with major company in Mid-Continent areas desires change to expanding independent production company. Location optional. Box G-750, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION Superintendent: 25 years in the field, 10 years supervising drilling and completion of wells in Oklahoma. Age 54. Married. Good health. Prefer Central Oklahoma. Box G-747, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGICAL degree, 7 years' Gulf Coast experience with 2 major companies. Production and regional geology, oil and gas reserve calculations, submittal evaluations, log interpretation, "well sitting." Age 34, married, one child. Location immaterial. Box G-745, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, B.S. Degree, 5½ years production, drilling and reservoir experience. Married, age 28, now employed as district engineer for large independent. Desires position with independent in U.S.A., Mexico or Canada. Box G-758, The Oil and Gas Journal, Tulsa, Okla.

18 YEARS experience as Petr. Engineer, drilling and production supt., both in drilling contracting and producing. Employed, desire change. Box G-759, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER — Broad experience—operations, maintenance, process, construction, sales, market and economic surveys. Desires administrative position in expanding oil or chemical company or as equipment manufacturer's sales representative. Southwest location preferred, graduate registered engineer. Age 46. Box G-757, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PETROLEUM ENGINEER, B.S., 28, married, 26 months oil field experience, desires job anywhere in U. S. Write Box 1751, Hobbs, New Mexico.

LEASE AND DRILLING BLOCKS

DRILLING DEALS—80 and 100 acre leases in Montgomery County, Kansas. Write W. J. Forsyth, 117 So. Penn., Independence, Kansas.

WANTED: Lease to drill, not over 4,000 ft., in Oklahoma or Tri-State Area. Box G-726, The Oil and Gas Journal, Tulsa, Oklahoma.

SHALLOW OIL FIELD, 1000-acre lease, three wells just completed, laboratory reports. Will **TURN IT OVER** for enlargement or sell for $45,000.00. Excellent water flow. Mr. C. Shepard, 1314 South Grant, Chanute, Kansas.

DRILLING DEAL: Pawnee County, Oklahoma; 240 acres; 3 sands; between production; demand reliable operator, quick action; 2800 feet. Phone 1258, Seminole, Oklahoma.

FOR SALE: 6,000 acres federal leases in Powder River basin. 12,000 acres in Utah. A. C. Trapp, 1477 Ridgeway Rd., Dayton, Ohio.

FOR SALE: Oil and Gas Leases: 200 acres in 3N-3E, Garvin County, Oklahoma, at $10.00; 400 acres in 3N-4E, Pontotoc County, Oklahoma, at $5.00; 8,000 acres in 2N-20E, DeBaca County, New Mexico at $1.50; 1,800 acres in Sherman County, Kansas. Box G-748, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED—Settled oil production, approx. 1,500 bbl. per day, with proven acreage to drill. Give complete details in first letter. Be sure you can deliver. Stauffer, 108½ E. Grand River, Howell, Michigan.

10,700-ACRE Oil and Gas Lease on Anticline joining new Gas Discovery in Utah. Gas contracted by pipe line that will help drill it. R. Barnsley, 950 Lincoln Ave., Palo Alto, California.

AVAILABLE 30,000 acres SE Colorado, $2. Drilling requirement two wells. Box G-749, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

SEE A. L. Bowles, Rollow Building, Ada, Oklahoma, for drilling deals.

LOOKING FOR A LEASE? There will be over 40,000 wells drilled this year. If you are looking for a lease, drilling block, or drilling deal and haven't found it in this column, or if you have a lease or drilling block you want drilled, a Journal classified advertisement can find an interested party. See box heading for classified rates, or write The Oil and Gas Journal.

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FOR SALE OR LEASE: 6000 sq. ft. tile and steel office building for sale with parking space down town one block from Lincoln Hotel, or will lease 3000 sq. ft. Very reasonable. Britton & Moman, 415 N. Sam Houston, Odessa, Texas. Tel. 7-1581.

SPACE IS NEEDED: A Journal display classified advertisement is the quickest way to rent or sell your real estate. In the present period of expansion oil industry firms urgently need the space you have available. If it isn't listed here, you may also find it by stating your needs in these pages. For classified rates see box heading or write The Oil and Gas Journal.

MAILING LISTS

MAILING LISTS of the oil industry. Our 30th year. Send for catalogue. Oil Industry Mailing List Co., 405 Tuloma Bldg., Tulsa, Okla.

ROYALTIES

QUICK Cash for your producing royalties, over-riding royalties, and production. Robert Kinkaid, Post Office Box 26, Tulsa, Oklahoma.

GET TOGETHER: Both Capital and Royalties are available. If the investment proposition you want isn't listed in this column, use a Journal classified advertisement to find it. See box heading for classified rates, or write The Oil and Gas Journal.

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The Oil and Gas Journal

Tulsa, Oklahoma

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WASHINGTON COMMERCIAL CO., 1200 Fifteenth St. N. W., Washington 5, D. C.

Canadian Fields

(Continued from page 191)

driller in the northern sector of Hamilton Lake, and are running string of production casing for further testing of that zone. The Hamilton Lake region lies about 135 miles northeast of Calgary.

The well, Calvan 7-35 Homestead, LSD 7, 35-35-10w4, is ¾ mile north of the Calvan-Homestead 10-26 H. B. oil well, and lies on farmout lands from the Western Homestead Oils, Ltd., group. The Hamilton Lake sand in the Viking formation was contacted at 2,918 ft., or 360 ft. subsea, and first drill-stem test was run for 1 hour from 2,882-2,915 ft. Gas flowed at rate 400,000 cu. ft. daily and recovery was 60 ft. mud. Thirty-minute test 2,921-34 ft. gave a good initial puff and recovery of 10 ft. mud. The oil came during 2-hour test from 2,918-34 ft. Gas flowed in 1½ hours and recovery was 130 ft. oil. Hole is bottomed at 2,934 ft. and casing is being run.

Tunstall area . . . Amurex Oil Development Co. has struck a moderate flow of natural gas in an unidentified formation at a wildcat on farmout lands from Canada Southern Oils, Ltd., in the Tunstall area of southwest Saskatchewan, about ½ mile east of the Alberta border.

This small gas find came at Amurex-Canada Southern 1-10 Odenback, LSD 10, 23-14-30w3, 28 miles northeast of Medicine Hat and 30 miles northwest of Maple Creek. Initial drill-stem test in the gas formation was run from 1,564-72 ft. Natural gas flowed in 3½ minutes, at rate 116,000 cu. ft. daily. Recovery was 45 ft. of mud in 1 hour. A 105-minute test from 1,572-82 ft. flowed gas at 286,000 cu. ft. daily and gave up 70 ft. of mud. Last test, from 1,565-95 ft., flowed gas at rate 321,000 cu. ft. daily during 110-minute test. Hole was carried down to 1,595 ft., and 5½-in. casing is set at 1,560 ft.

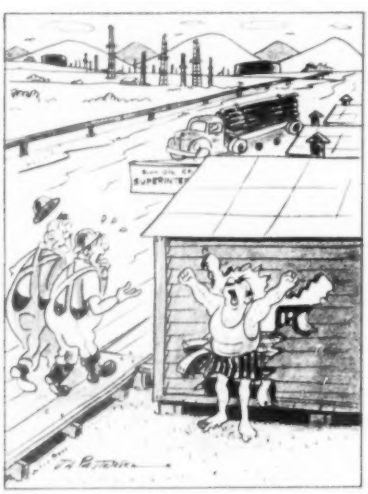
EASTERN CANADA

Ontario . . . In Lambton County, Imperial Oil Co. well on the Gordon Hollingsworth farm, on the 12th Line near Watford, is proving one of the best producers drilled in Lambton since the Petrolia oil boom many years ago. It is flowing 130 to 140 bbl. a day from the Guelph-Niagara formation at 1,860 ft. Production is 30.4°-gravity crude, lower in quality than the normal 36°-gravity crude of the Ontario shallow fields.

Imperial's Eastern Division, under the general direction of W. A. Roliff, is continuing a survey and development program started in Lambton in 1945. Permission has been secured from Warwick Township to carry on seismographic surveys on the 12th Line north of the second sideroad. An earlier survey program, jointly handled by Imperial, Union Gas Co. and the Ontario government, failed owing to the nature of the soil; but new techniques are expected to overcome this difficulty. Imperial is drilling a second test ¼-mile south of the Hollingsworth producer, and two others will be drilled within a ¾-mile radius.

In Sombra Township, Lambton County, a test drilled by Ross McPherson for Stanwell Oil and Gas, Ltd., on the Florence and Martin O'Leary farm, Lot A, concession 6, struck a large pocket of gas under heavy pressure at 137 ft. in the overburden. The gas blew stones and water 250 ft. in the air. The well is deepening for a test of formations underlying the Guelph-Niagara.

In Lake Erie, opposite Port Alma, Consolidated West Petroleums 9, drilling 1¾ miles off shore in 47 ft. of water, was completed as a gasser at 1,225 ft. depth and established a measured open flow of 1,870,000 cu. ft. a day. Location is ¾-mile from the No. 8 producer. Both wells have been connected to the company's line. Platform and outfit have been beached for the season, but additional lake wells will be drilled in 1954.



"I dread today—he's gettin' up on the wrong side of the bed again."

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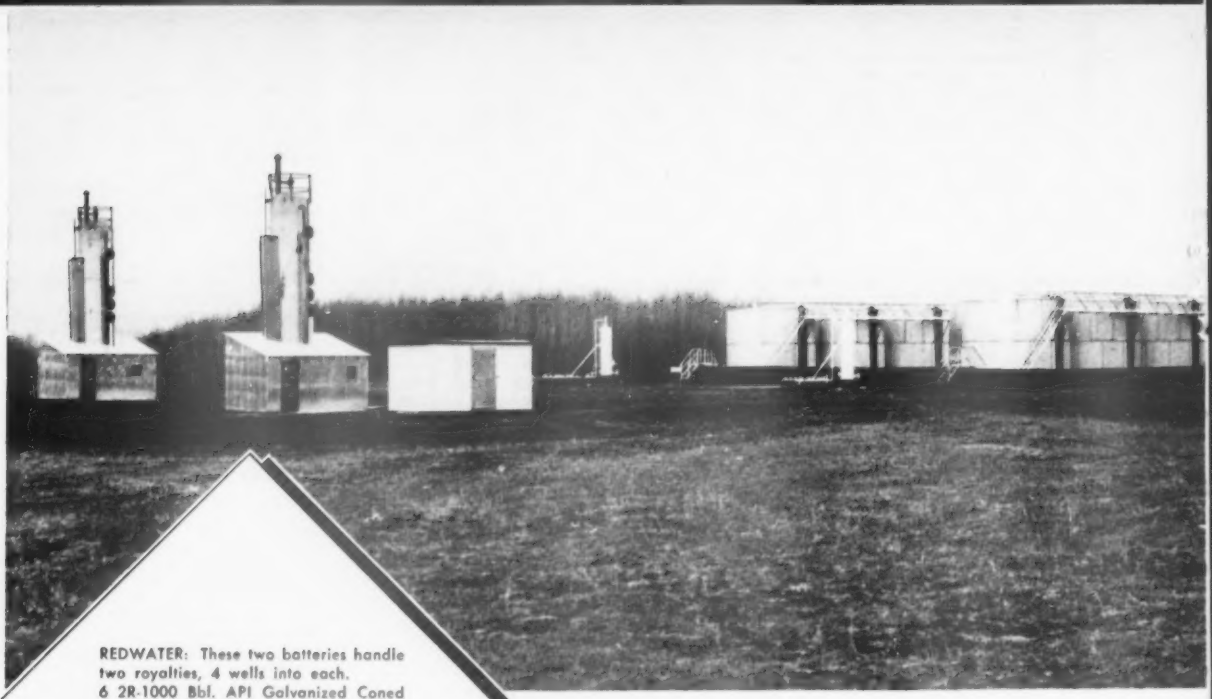

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2 6' x 27½' "YCP" 15# National Emulsion Treaters

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